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(1)

This kit is compiled from research done by the Toronto Area Airports Project team over the past five years.

The kit is not designed to satisfy the specialist, but rather to inform the general public as to the rationale behind the decision to not expand Malton and the choice of Pickering as the site for the second airport for Toronto.

The research reports leading to this decision were made available to the public under the terms of the Expropriation Act and are available for study at the project offices, Thomson Building, 65 Queen Street West, Toronto, M5H 3K9 (369-4919).

G.E. McDowell,
General Manager,
Toronto Area Airports Project.

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AN ASSESSMENT OF THE DEMAND FOR THE USE OF BOTH OFFICIAL LANGUAGES IN CANADIAN DOMESTIC AIR/GROUND COMMUNICATIONS.

PROJECT BILCOM

AN ASSESSMENT OF THE DEMAND FOR THE USE OF BOTH OFFICIAL LANGUAGES IN CANADIAN DOMESTIC AIR/GROUND COMMUNICATIONS

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SECTION A

Task Force

Personnel

Management Board

W. M. McLeish	-	Director General, Civil Aeronautics, Chairman
H. M. Hutchon	-	Director, Air Traffic Services
F. E. Lay	-	Director, Telecommunications, Air
R. L. Bolduc	-	Chief, Regulations and Standards
H. R. Finley	-	Chief, Aviation Safety

Task Force

R. H. Wickware	-	Ottawa Headquarters, Project Leader
R. Bérubé	-	Quebec Regional Headquarters
L. Doucet	-	Quebec Terminal Control Unit
D. J. Douglas	-	Ottawa Headquarters
R. Douville	-	Quebec Regional Headquarters
G. P. Dunn	-	Ottawa Headquarters
C. G. Foy	-	Ottawa Headquarters

Regional Coordinators

Atlantic	-	D. Lamont
Ontario	-	G. Lloyd
Central	-	N. Addaway
Western	-	K. Caney
Pacific	-	G. Lentsch

Report Issued on March 31, 1975.

SECTION A

TASK FORCE OBJECTIVES AND TERMS

Objectives

1 To determine the extent and nature of demand for the use of both official languages in the provision of air traffic control and other services provided to pilots through air/ground communications during flight time;

2 To make recommendations on the means of meeting such demand and to assess the implications in aviation safety and resources (human and financial).

Terms

The study should concentrate on the Province of Quebec but extend to other parts of Canada as necessary. The intent is to examine only the requirements of domestic operations. In order to acquire essential information it will be necessary to contact representatives of the clientele including companies and associations such as COPA, CALPA, CATCA, etc. The study should be completed as expeditiously as possible.

SECTION A

Background

In 1962, as a result of inquiries regarding the use of the French language in Air Traffic Control, the Director of Civil Aviation issued a policy calling for the use of English language in the provision of air traffic control services. However, use of the French language in certain unusual situations such as those of emergency or stress was authorized.

In 1969, an Air Traffic Control Occupational Study (ATCOS) was initiated for the conduct of an in-depth review of air traffic control operations as related to the controller, his environment and working conditions. The study discussed bilingualism and analysed the implications of the Official Languages Act as they relate to air traffic control, making a number of appropriate recommendations. As a follow-up to this occupational study, an Air Traffic Control Implementation Team was formed to further evaluate and implement these ATCOS recommendations to meet existing or anticipated requirements in the best interest of users and providers of air traffic services.

In 1971, a study aimed at assessing "the implications in designating French language units in Air Traffic Control Towers as this affects air/ground communications" was conducted. The study established the fact that no language problems appeared to exist in Canada outside of the Province of Quebec. In this latter case, it concluded that while no major problems had

SECTION A

Background (cont'd)

been encountered in Quebec City, Sept Iles or Baie Comeau (control towers) over the use of the English language, situations existed wherein private pilots having limited knowledge of English required French language to obtain assistance. The study forecast that the designation of Quebec City, Sept Iles and Baie Comeau (control towers) as French language units on an experimental basis should not cause difficulties since it would only serve to confirm an existing situation rather than to introduce changes.

In June of 1974, the Ministry authorized the use of the French language, in addition to English, in the provision of airport control service to aircraft operating in accordance with the Visual Flight Rules in the vicinity of five MOT controlled airports located in the Province of Quebec (Quebec City, Sept Iles, Baie Comeau, St Jean, St Honoré). Such authorization had been preceded by a limited Aviation Safety Investigation of the situation then prevailing at Quebec City (terminal control unit and control tower) regarding the use of both official languages in the provision of control services.

SECTION A -

Activities

- Letters requesting position statements from national and regional organizations representative of the Canadian Aviation Industry.
- Development and circulation of a questionnaire addressed to pilots which achieved:
  - national distribution through the various national/regional associations and organizations;
  - individual distribution to all pilots residing in the Province of Quebec, using Aeronautical Information Services mailing lists.
- Public meetings held at:
  - Baie Comeau, Matagami, Mont Joli, Montreal(2), Quebec City, Rouyn, St Honoré, Sept Iles and Val d'Or in the Province of Quebec;
  - New Liskeard and Timmins in the Province of Ontario;
  - Edmonton in the Province of Alberta;
  - Vancouver in the Province of British Columbia.

SECTION A

Activities (cont'd)

- Meetings with MOT Regional representatives were held at Moncton, Montreal, Toronto, Winnipeg, Edmonton and Vancouver. Each region had undertaken the task of identifying areas of concern and interest for consideration by the Task Force.
- On-site visits were made to Air Traffic Services and Telecommunications and Electronics facilities and to numerous flying clubs, schools, local and regional operators.
- A number of general aviation airports (Bromont, Carp, Drummondville, Rockcliffe, Russell, Les Cèdres, St Jérome, Ste-Thérèse and Sherbrooke) were visited.
- Review of questionnaire returns.
- Consultation with Department of Communications.
- Exchange of information with Department of National Defence.
- Some members of the Task Force travelled to Europe for the purpose of obtaining first-hand knowlege of air operations within multi-language areas.

  Air traffic control and telecommunications facilities at Paris, Brussels, Maastricht (Eurocontrol) and Rome were visited. In addition, meetings were held with aviation representatives of the countries concerned.

SECTION A

Language Situation in Europe

France

French is the language normally used throughout the country. English is available and used to meet the requirements of international air operations.

In an area such as Paris, the French/English usage distribution is approximately:

- Enroute traffic (PARIS Area Control Centre - 20% French - 80% English)
- Terminal Control Areas and Towers - 50% French - 50% English.
- Military traffic (French Air Force) - 100% French.
- Local training & recreational flight activities (outside of Orly and Charles de Gaulle Terminal Control Areas) where air/ground communications exist - 100% French.

The examination language requirement to obtain the Restricted Radiotelephone Operators Certificate is:

Pilot - in the French language.

Controller - must demonstrate a sufficient knowledge of English (coincident with air traffic services training).

SECTION A

Language Situation in Europe (cont'd)

Belgium

French and English are used.

In an area such as Brussels, the French/English usage distribution is approximately:

Terminal (Brussels Terminal Control Area) & Tower - 15% French - 85% English.

Language to be used is determined by the pilot on first contact.

The controller, when initiating, uses English.

The examination language requirement to obtain the Restricted Radiotelephone Operators Certificate is:

Pilot - No requirement to demonstrate proficiency in English language. If wishing to attain higher pilot qualifications, English language training is available at the National School. The phraseologies used are those of ICAO and it is assumed that candidates are familiar with them.

Controller - Since ATS training is given exclusively in English, the examination is in that language. However, the ICAO French phraseology is also taught.

Eurocontrol (Upper Area Control Centre, Maastricht, Holland)

Provides air traffic services in the upper airspaces of Belgium, Luxembourg and Northern Germany (Hanover Upper Flight Information Region).

The language normally used is English.

SECTION A

Language Situation in Europe (cont'd)

Italy

Air/ground communication services are provided by the Italian Air Force.

Italian is the language normally used throughout the country.

English is available and used to meet the requirements of international air operations.

At a location such as Rome/Leonardo da Vinci, the Italian/English usage distribution is approximately:

- Terminal Control Area and Tower - 30% Italian - 70% English with these precentages reversing in the case of "on the ground" traffic.

The military examination language requirement to obtain the Restricted Radiotelephone Operators Certificate is:

Pilot and controller - Required to demonstrate proficiency in the English language.

Note: Information relating to civilian pilots was not obtainable.

SECTION A

Language Situation in Europe (cont'd)

The following information was obtained from the ICAO Paris Office.

Germany

English is the language normally used throughout the country. Provision is made for the use of German language to cater to the needs of non-English speaking pilots. (This is done using a discrete frequency).

Scandinavian Countries

English is the language normally used. Discrete frequencies usually are available to cater to non-English speaking pilots' requirements.

Spain

Spanish is the language normally used throughout the country. English is available and used to meet the requirements of international air operations.

Eastern Europe

National languages are normally used.

English is available and used to meet the requirements of international air operations.

Russian is also used to some extent in most countries.

SECTION A

ICAO Principal Recommendations regarding Language to be used in Air-Ground Radiotelephony Communications (ICAO - Annex 10, Vol II, Chapter 5, Section 5.2)

Recommendation 5.2.1.1.1 - In general, the air-ground radiotelephony communications should be conducted in the language normally used by the station on the ground.

Note - The language normally used by the station on the ground may not necessarily be the language of the State in which it is located.

Recommendation 5.2.1.1.2 - Pending the development and adoption of a more suitable form of speech for universal use in aeronautical radiotelephony communications, the English language should be used as such and should be available on request from any aircraft station unable to comply with 5.2.1.1.1, at all stations on the ground serving designated airports and routes used by international air services.

Note 1 - While the Contracting State designates the airports to be used and the routes to be followed by international air services, the formulation of ICAO opinion and recommendations to Contracting States concerned is carried out periodically by Council, ordinarily on the basis of recommendations of Regional Air Navigation Meetings.

Note 2 - In certain regions the availability of another language, in addition to English, may be agreed upon regionally as a requirement for stations on the ground in that region.

Note 3 - The development mentioned in 5.2.1.1.2 is the subject of continuing study and the broad principles of this study are laid down in Attachment B.

From these recommendations, it is apparent that basically, the language recommended for the conduct of air/ground communications is that normally used by the station on the ground. However, in order to facilitate the conduct of international flight operations, ICAO further recommends that the English language be available on request from any international flight unable to comply with Recommendation 5.2.1.1.1 at all ground stations catering to international operations.

SECTION A

Language Situation in Canada

Definition of "Demand" - The term "demand", as used in the description of the objectives, refers to the language requirements stated by Canadian users of MOT air/ground communication services.

Statement of Intent - The existing national requirement for the use of the English language in air/ground communications meets with universal acceptance. Therefore, any demand for bilingual services must relate only to the feasibility of also using the French language to achieve air/ground understanding without infringing on safety. One should not so much be concerned with personal or collective language rights (Official Languages Act) as with personal or collective responsibility towards safety (Aeronautics Act).

Scope of Project - The scope is limited to an examination of the language requirements of Canadian domestic operations. In this context, the application of ICAO Recommendation 5.2.1.1.1 must reflect the fact that, in Canada, there are two official languages.

Any consideration of an international nature is outside the terms of reference assigned to the Task Force. Notwithstanding, for the purpose of international flight operations, it is acknowledged that English is the only language used in Canada.

SECTION A

Extent and Nature of Demand for Bilingual Services in Canada

No demand for air/ground communications in the French language originated outside of the Province of Quebec.

Within the Province of Quebec, a demand for the use of French, in addition to English, has been identified. Such demand extends beyond the confines of the province itself to include the National Capital Region. Also, some interest could be detected in relation to airports located in Northeastern Ontario.

Facilities considered in the Province of Quebec were:

(i) MOT Aeradio Stations:

Fort Chimo
Fort George (La Grande)
Gaspé
Inoucdjouac (1975)
Lake Eon
Matagami
Mont Joli
Montreal
Nitchequon
Poste de la Baleine
Québec
Roberval
Rouyn
Schefferville
Sept Iles
Sherbrooke

(ii) MOT ATS Facilities:

Area Control Centre	Terminal Control Units	Control Towers
Montreal	Montreal	Baie Comeau
	Mirabel (1975)	Montreal/Dorval
	Quebec	Montreal/Mirabel (1975)
		Montreal/Victoria Park
		Quebec
		St Honoré
		St Hubert
		St-Jean
		Sept Iles
		Val d'Or (August 1975)

(iii) Military Air Traffic Control Facilities

Bagotville
Val d'Or

SECTION A

BILCOM QUESTIONNAIRE FOR PILOTS

1. What is your occupational group?

Commercial pilot? ( )
Private pilot? ( )

2. What percentage of time do you operate in each of the general localities?

	up to 10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Maritimes	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Quebec	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Ontario	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Prairies	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Rocky Mountains	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )
Pacific Coast	( )	( )	( )	( )	( )	( )	( )	( )	( )	( )

3. What percentage of your flying is conducted under:

the Visual Flight Rules (%)
the Instrument Flight Rules (%)

4. Do you consider use of both English and French to be necessary in domestic air/ground communication?

Yes ( ) No ( )

5. Which language would you use in air/ground radio communication if you had a choice?

English ( ) French ( )

6. Comments:

SECTION A

CONFIDENTIAL

SURVEY RESULTS

The bilingual questionnaire circulated among licenced pilots in the Province of Quebec has drawn 2711 replies from 7551 mailed, a response of 35.9%.

The demand for each language is reflected by the responses to Questions 4 and 5, Questions 1, 2 and 3 being designed to illustrate the individual backgrounds of the responders. No signatures were requested.

English language replies	1882
French language replies	829
	2711

Question 4

Do you consider use of both English and French to be necessary in domestic air/ground communication?

	COMMERCIAL PILOTS		PRIVATE PILOTS	
	Yes	No	Yes	No
Answers given in English language	102	879	148	753
Answers given in French language	410	227	158	34

QUESTION 5

Which language would you use in air/ground radio communication if you had a choice?

	COMMERCIAL PILOTS		PRIVATE PILOTS	
	English	French	English	French
Answers given in English language	972	9	875	26
Answers given in French language	373	264	61	131

SUMMARY:

	Yes	No
Question 4	818 (30%)	1893 (70%)
	French	English
Question 5	430 (16%)	2281 (84%)

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 1

Bilingual Airports

"Bilingual air/ground communications should be authorized in the provision of Airport Control Service to aircraft operating in accordance with the Visual Flight Rules in the vicinity of MOT controlled airports at Quebec City, St Jean, Sept Iles, Baie Comeau, St Honoré and Val d'Or."

Note. - The responsibility for the provision of Airport Control Service at Val d'Or will transfer from the Department of National Defence to the Ministry of Transport on August 1, 1975.

In the application of this recommendation, particular emphasis should be placed on:

- language to be used is determined by the pilot on initial contact.
- ATS, when initiating, should use English.
- strict adherence to English/French standard phraseologies.
- position/traffic information to be issued, as necessary, to assist pilots in establishing safe separation from other aircraft.

Operating experience gained since the implementation of NOTAM 12/74, including investigation of complaints related to the provision of bilingual services, has revealed no evidence that this NOTAM is not valid.

SECTION B

Bilingual Airports (cont'd)

A strong desire has been expressed by a number of unilingual French VFR pilots, operating from locations in northwestern Quebec, for the provision of bilingual Airport Control Service at Val d'Or.

Remark:

The current "Programme Forecast/Five Year Plan" calls for the implementation of airport control towers at the following locations in the Province of Quebec: Drummondville, Les Cèdres, Matagami, Mont Joli, Rouyn, St Jérome, Ste Thérèse, Sherbrooke and Trois-Rivières. Barring unexpected changes to the existing demand for bilingual services, it can be anticipated that this Recommendation would apply in respect of each location.

SECTION B

St Hubert (cont'd)

While the St Hubert control system is geared to handle such a high volume of air traffic, the complexity factors it can absorb must remain within the limits of its physical and human resources. There is a limit to the number of aircraft which can be accommodated safely at any time as well as to the ability of a controller to maintain control proficiency using two languages. The restricted designation, as recommended above, may in itself cause problems requiring constant monitoring through close coordination between all agencies concerned. However, the introduction of biligualism in air/ground communications at St Hubert will serve to satisfy the demand of Montreal area candidates for the opportunity to learn to fly VFR using their mother tongue.

There is no need to establish the French/English population ratio of the area or clientele served by St Hubert Airport to justify the recommendation, as both the French and English realities of the area are self-evident.

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 4

Montreal/Victoria Park STOLport

"Airport Control Service to STOL aircraft operating at the Montreal/ Victoria Park STOLport should continue to be provided in English only."

No known requirement exists for the provision of bilingual services at this airport.

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 5

Special VFR

"Bilingual air/ground communications should be authorized in the provision of Airport Control Service to Special VFR flight at MOT controlled airports where air/ground communications are conducted in both official languages."

This recommendation constitutes a logical follow-up to the recommendations dealing with the authorization of bilingual communications in the provision of Airport Control Service to aircraft operating in accordance with the Visual Flight Rules.

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 6

Terminal Radar Service Area/Montreal

"Bilingual air/ground communications should be authorized in the provision of Terminal Radar Service to aircraft operating in accordance with the Visual Flight Rules within the Montreal Terminal Radar Service Area (TRSA)".

Note 1 - The Montreal TRSA is scheduled for implementation by late 1975.

Note 2 - It can be anticipated that this recommendation would find equal application in the case of the proposed Mirabel Terminal Radar Service Area (TRSA).

In the application of this recommendation, particular emphasis should be placed on:

- language to be used is determined by the pilot on initial contact;
- ATS, when initiating, should use English;
- strict adherence to English/French standard phraseologies.

The availability of bilingual services to VFR flight operating within the TRSA would be in keeping with the objective of the TRSA concept which is to increase safety to both IFR and VFR aircraft operating simultaneously in high density terminal areas.

It can hardly be envisaged that a VFR aircraft meeting all TRSA pre-requisites (ANO. Series V. No. 25) would be denied the right to operate within the TRSA because of language considerations. In addition, it should be noted that the TRSA will serve one airport (St. Jean) which has been designated bilingual by NOTAM 12/74 and one which is the subject of Recommendation 2 (St Hubert).

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 7

IFR/Controlled VFR

"Air Traffic Control Services should be provided in English language only for aircraft operating:

i) in accordance with the Instrument Flight Rules;
ii) in VFR flight within Block Airspace."

Note - User demand from the Province of Quebec will need to be monitored closely in relation to prevailing operational conditions. One such condition could refer to bilingual Airport Control Service.

Theoretically, bilingualism in the provision of control services for the purpose of IFR flight can be accommodated safely. However, when related to present circumstances, a number of factors render the provision of bilingual services inadvisable. Some of these factors are:

- insufficient pilot demand;
- conditions (e.g. weather, airport, navigation aids, unusual in-flight situations, emergencies, etc.) which could result in an IFR flight having to operate in airspace within which communication services are provided in English only, not to mention the added possibility of having to land at an airport location served by such airspace;
- undesirable aspects of language mix in IFR operations in uncontrolled airspace involving air/air as well as air/ground communications;
- the career oriented VFR pilot or student pilot is aware of the English language requirement dictated by the North American environment;

SECTION B

IFR/Controlled VFR (cont'd)

- a clear majority of the VFR pilots and student pilots interviewed have indicated a willingness to learn aeronautical English as part of attaining further pilot qualifications.

In summary, although there exists some demand for the use of French language, the provision of bilingual communication services to IFR flight is not a requirement at this time.

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 8

National Capital Region

> "Bilingual air/ground communication capability in the National Capital Region should be developed to permit access to the National Capital by French-speaking pilots of aircraft operating in accordance with the Visual Flight Rules."
>
> Note 1 - Based on existing airport facilities in the National Capital Region, this capability relates to Ottawa International Airport and/or Carp Airport (control tower scheduled for late 1975).
>
> Note 2 - It is recognized that the implementation of this Recommendation would prove difficult, particularly noting that the nature of the demand suggests bilingual Airport Control Service.

The availability of bilingual air/ground communication services in the National Capital region would serve to satisfy a demand to that effect stated by French-speaking pilots from the Province of Quebec.

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 9

Bagotville Airspace

"Coordination should be initiated with Department of National Defence (DND) to investigate the possibility of the military air traffic control facility at Bagotville providing bilingual air/ground communication services to civil VFR aircraft operating within the airspace under Bagotville jurisdiction."

Current military regulations call for the provision of air/ground communications for the purpose of air traffic control in the English language only. Indications are that some VFR radio-equipped aircraft operate NORDO within the Bagotville Terminal Control Area due to the language restriction.

SECTION B

AIR TRAFFIC SERVICES

RECOMMENDATION 10

Automatic Terminal Information Service/Quebec City

"Automatic Terminal Information Service (ATIS) for the benefit of arriving and departing aircraft at Quebec City Airport should be available in both official languages."

Note 1 - This requirement could be met by broadcasting alternating English and French ATIS messages on existing frequencies, or by broadcasting separate English and French ATIS messages on different frequencies.

Note 2 - This recommendation would find equal application in the event of introduction of ATIS at any other MOT controlled airport where bilingual air/ground communication is approved.

A function of ATIS is to provide current operational information for the benefit of arriving and departing aircraft. The information provided is equally important to English-speaking and French-speaking pilots.

SECTION C

TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 11

IFR/Controlled VFR Communications Processing

"The air/ground processing by Aeradio Stations of air traffic control/ aircraft communications (clearances, instructions, position reports, requests, etc.) associated with the conduct of IFR and Controlled VFR flight operations should be conducted in English only."

(See Recommendation 7).

SECTION C

TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 12

Airport/Flight Advisory Services

"Except for the air/ground processing of IFR and Controlled VFR air traffic control/aircraft communications, bilingual air/ground communications should be authorized in the provision of Airport and Flight Advisory Services by all Aeradio Stations in the Province of Quebec. Whenever flight safety is involved, the gist of the advisory information exchanged in one language must be transmitted in the other language for the benefit of other aircraft."

Note - In line with this Recommendation and Recommendation 5, the provision of bilingual Airport Advisory Service will need to extend to Special VFR flight.

In the application of this recommendation, particular emphasis should be placed on:

- Except for the exchange in English of IFR and Controlled VFR movement and control messages, language to be used is determined by the pilot;
- Aeradio Station, when initiating, should use English;
- strict adherence to English/French standard phraseologies;
- ensuring exchange of information in the interest of flight safety.

Opinions obtained at public meetings, through the questionnaire and by contact with pilots and radio operators, have revealed a strong demand for the provision of bilingual Airport and Flight Advisory Services by Aeradio Stations.

In recent years and particularly since the promulgation of ATS NOTAM 12/74, more and more pressure has been applied by pilots to obtain services in both official languages from Aeradio Stations in the Province of Quebec. This has placed radio operators in the position of having to make a choice between meeting the demand of the French-speaking pilot clientele or adhering to directives. This is particularly evident at locations where Airport Advisory Service is available.

SECTION C

TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 13

Scheduled Broadcasts

"Scheduled broadcasts by Aeradio Stations in the Province of Quebec should be provided in both official languages."

Note - It is recognized that the introduction of a bilingual broadcast service would further tax resources at high activity stations. Bilingual Transcribed Weather Broadcast Service at key locations would obviate the need for scheduled broadcasts. (Recommendation 15 refers)

SECTION C

TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 14

Unscheduled Broadcasts

"Unscheduled broadcasts by Aeradio Stations in the Province of Quebec should be provided in both official languages."

SECTION C

TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 15

Transcribed Weather Broadcast Service

"Transcribed Weather Broadcast (TWB) Service provided in English language by Montreal Aeradio should also be made available in French language."

Note 1 - Coordination between the Ministry of Transport and the Department of Environment will need to be initiated to explore means of obtaining the required bilingual meteorological information.

Note 2 - This requirement could be met by providing unilingual French and English broadcasts on separate frequencies. Alternating English language messages and French language messages on the same frequency would be impractical due to the duration of the transmissions (up to 10 minutes each).

Note 3 - This recommendation would find similar application at locations in the Province of Quebec where TWB may be installed at a later date.

SECTION D

AIR TRAFFIC SERVICES/TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 16

Vehicular Traffic

"Bilingual communications should continue to be authorized in the provision of Ground Control Service/Vehicle Advisory Service to vehicular traffic on airports in the Province of Quebec where such services are provided by an MOT Control Tower or Aeradio Station."

In the application of this Recommendation, particular emphasis should be placed on:

- operational agreements between the control tower/aeradio station and the concerned agencies to ensure understanding of and adherence to approved phraseologies by vehicle operators.

For a number of years, bilingual communication services have been provided for the purpose of directing and monitoring vehicular traffic on airports in the Province of Quebec. This has resulted in safe operations.

SECTION D

AIR TRAFFIC SERVICES/TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 17

Operational Support Data

"Bilingual operational support data such as Class I NOTAM and meteorological information should be provided to enable full implementation of Recommendations."

Note - Action by agencies responsible for the provision of support data will need to be initiated to develop ways of meeting this requirement.

SECTION D

AIR TRAFFIC SERVICES/TELECOMMUNICATIONS AND ELECTRONICS

RECOMMENDATION 18

Use of French Language in Other Circumstances

"Whenever flight safety can be enhanced by use of French language in air/ground communication and where a provider capability exists, such capability should be utilized."

Note - This could occur, for example, in the provision of radar assistance to VFR flight, Very High Frequency (VHF) Direction Finding Service and assistance to aircraft in unusual situations such as stress or emergency.

SECTION E

GENERAL

RECOMMENDATION 19

UNICOM - Private Advisory Stations

"Coordination should be initiated between the Ministry of Transport and the Department of Communications for the purpose of reviewing the policy governing the operational use of UNICOM as related to language considerations."

Problems related to language on UNICOM frequencies at uncontrolled aerodromes in the Province of Quebec have been mentioned on a number of occasions as constituting a potential hazard to air safety.

While some stations have a bilingual capability, others may be unilingual. The combination of language mix, the uncontrolled environment, the private nature of UNICOM facilities and the possible lack of traffic exchange by the ground station could impair the value of UNICOM as an aid to safe and expeditious movement of aircraft.

SECTION E

GENERAL

RECOMMENDATION 20

Designation of Bilingual Services in
Aeronautical Information Publications (AIPs)

"Designated bilingual air/ground communication services and the locations from which they are provided should be clearly identified in appropriate aeronautical publications."

SECTION E

GENERAL

RECOMMENDATION 21

Aeronautical Phraseologies/Terminologies

"Adequate French language aeronautical phraseologies/terminologies should be developed and disseminated, as appropriate, to users and providers of bilingual air/ground communication services."

Note - Consideration could be given to making available audio/audio-visual aids to flying clubs, schools, groups and other members of the flying public to promote understanding in air/ground communications.

SECTION E

GENERAL

RECOMMENDATION 22

Language Proficiency

"A level of bilingual aeronautical language proficiency appropriate to the provision of bilingual air/ground communication services should be established for controllers and radio operators."

Note 1 - This level of proficiency would need to be maintained at all locations where air/ground communications are conducted in both official languages.

Note 2 - As a complement to formal training, the provision of language laboratories is seen as an effective aid to language proficiency.

SECTION E

GENERAL

RECOMMENDATION 23

Restricted Radiotelephone Operators Certificate (RROC)
(Issued by the Department of Communications (DOC))

"Representations to the Department of Communications should be made for their consideration of the following:

a) the examination for the issuance of the RROC, including demonstration of the exchange of safety and control messages should be given in either English or French, the choice of language being left with the applicant.

b) In the interest of flight safety the applicant should be urged to familiarize himself with standard phraseology in the other official language.

c) At the time of the examination the applicant should be reminded that:

i) the basic aviation safety principle that a pilot must not exceed his capabilities also refers to language.

ii) since air/ground communication services in the French language are not universally available, a pilot with insufficient ability in the use of English terms and standard phraseologies should avoid operating in areas where aircraft two-way radio equipment is mandatory and within which services are provided in English only."

Note - In addition, DOC and MOT should ensure that the above information is disseminated throughout the aviation community for the benefit of all current holders of the Restricted Radiotelephone Operators Certificate.

The procedure governing the issuance of the RROC has been subject to controversy.

The objective of the examination for the RROC is to achieve understanding of the basic radio operating procedures, particularly as related to safety and distress, thereby ensuring pilot awareness of regulations and good airmanship practices. The examination is really an educational exercise aimed at attaining the stated objective.

SECTION E

GENERAL

RROC (cont'd)

One does not fail the examination, but is rather given needed instruction/guidance until a satisfactory level of understanding of the procedures is reached. When viewed in that perspective, the question of language becomes irrelevant. It matters not whether the examination is given in English or in French, since regulations and good airmanship practices have the same meaning and impose similar obligations in both languages. Safety assumes a two-language dimension in a bilingual environment.

Geographical limitation of the certificate issued to a unilingual French pilot was considered by the Task Force but deemed incompatible with the objectives of the examination.

SECTION F

SAFETY IMPLICATIONS

It is the opinion of the Task Force that, by meeting the intent of the recommendations of this report, flight safety will not only be maintained but will be improved. At the same time, it should be borne in mind that the introduction of bilingualism in air/ground communication services will need to take account of the complexity factors which may result. System capacity could be affected. This would be of importance at all times, but especially during the implementation phase. User and provider elements of the air traffic system should be afforded both the means and the time necessary to adjust to new bilingual operational environments.

Comprehension is an essential element in achieving a safe and orderly flow of air traffic and it attains maximum effectiveness when the language used for communications is the one in which the pilot is most fluent. Where a demand has been identified, the availability of services which will provide the pilot with a choice of language between English and French will serve to facilitate understanding, thus contributing to flight safety. Safety assumes a two-language dimension in a bilingual environment.

A discrete English/French frequency concept similar to that applied by some European States to meet language requirements was considered by the Task Force but deemed unacceptable for Canadian application. In the Province of Quebec, the extent of the demand for bilingual air/ground communication services suggests that use of separate English/French frequencies could result in flight safety being compromised rather than enhanced.

SECTION F

Safety Implications (cont'd)

Provision of the recommended bilingual services will enhance safety in various ways:

- reduce misunderstandings and delays attributable to pilot language limitations.
- minimize the risk of potentially dangerous situations developing. Without bilingual service, a pilot with little knowledge of English has to translate English messages into French before understanding and being in a position to react correctly, then reverse the mental process to acknowledge in English.
- reduce the use of "ROGER" as a last-resort pilot acknowledgement of a communication that is not understood, thus giving the controller/ radio operator a false indication of understanding.
- encourage pilots who were previously reluctant to use their radio because of language limitations to communicate with ground agencies and take full advantage of services available.
- enable pilots with language limitations to operate safely in areas where aircraft two-way radio equipment is mandatory.

Compatibility between pilot and controller/radio operator must be of the highest quality if the air traffic system is to result in the achievement of a safe, expeditious and orderly flow of air traffic. The pilot/controller/radio operator relationship must be based on mutual confidence through respect of each other's professional integrity. The apparent attitude of antagonism displayed by some users and some providers of the air services during public and private meetings held in connection with "BILCOM" could have undesirable effects on operational performance on the flight deck or at a control position.

SECTION F

Safety Implications (cont'd)

Systems are not immune to human error and the air traffic system is no exception. Errors have been made in the air as well as on the ground.

The pilot contribution in error prevention/detection has always been and should continue to be an important back-up element of the system. During visual meteorological conditions the pilot's primary aid in preventing collision is his eyesight, and a most important aid it is. Pilot monitoring of air/ground communications related to the operational environment can serve as a valuable aid in attaining flight safety; it does not necessarily result in an accurate "picture" of the activities taking place. With the advent of automation, the complexity of the airspace structure and the increasing sectorization of the air traffic control function, the pilot back-up capability will continue to be subjected to further limitations.

In a controlled environment, when flying in instrument meteorological conditions, the ability of a pilot to have a complete "picture" of the traffic operating in his general vicinity is non-existent. As an example, an aircraft flying from Montreal to Toronto under the Instrument Flight Rules monitors an average of ten different frequencies to cover the departure, enroute and arrival phases. Each frequency serves a control function which does not normally provide for the exchange of traffic information, unless deemed essential. Further, when radar identified, a flight is usually authorized to

SECTION F

Safety Implications (cont'd)

omit position reports. From the foregoing, it can be seen that only the control element of the air traffic system has a complete "picture", with each controller having a current "picture" of only the sector/function for which he is responsible.

In an uncontrolled environment, regardless of weather conditions, a pilot flying under the Instrument Flight Rules must provide for his own separation from other aircraft in the area. The need for each pilot to have the complete "picture" becomes a requirement which is usually met through listening to and understanding each other's radio transmissions during departure, enroute and arrival phases. The mandatory use of one language only for this purpose is considered essential to flight safety.

SECTION F

RESOURCE IMPLICATIONS

Generally speaking, the implementation of most Recommendations in this Report can be accommodated within the present resources.

However, additional resources may be needed for:

- the issuance of bilingual Class I Notam information;
- the provision and dissemination of required bilingual weather information;
- language training, audio/audio-visual aids, including language laboratories;
- implementation team;
- provision of bilingual aeronautical publications;
- ADIS and meteorological teletype network, depending on the ability of present systems to accommodate messages in both languages;
- dual TWB equipment at Montreal and at other high activity locations where bilingual air/ground communications may be provided;
- dual ATIS equipment at Quebec City and at other locations where bilingual ATIS may be authorized.

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Toronto area airports system

Toronto International Airport · Malton
development planning

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preface

This is the first in a series of documents whose aim is to describe the development of the aviation plan for Southern Ontario. These reports:

- explain the constraints which limit the potential for further development of the existing facilities at Toronto International Airport (Malton);
- discuss alternative sites for a new Toronto airport and describe the proposed aviation plan, consisting of a Toronto Area Airport System and an Airport System for Southwestern Ontario;
- forecast the impact of anticipated future technological development on the design of the aviation plan.

This document discusses the limitations on further development of the existing facilities at Toronto International Airport (Malton).

All documents were prepared and co-ordinated by the Canadian Air Transportation Administration of the Ministry of Transport. A number of agencies both public and private assisted in the preparation of the plan.

2

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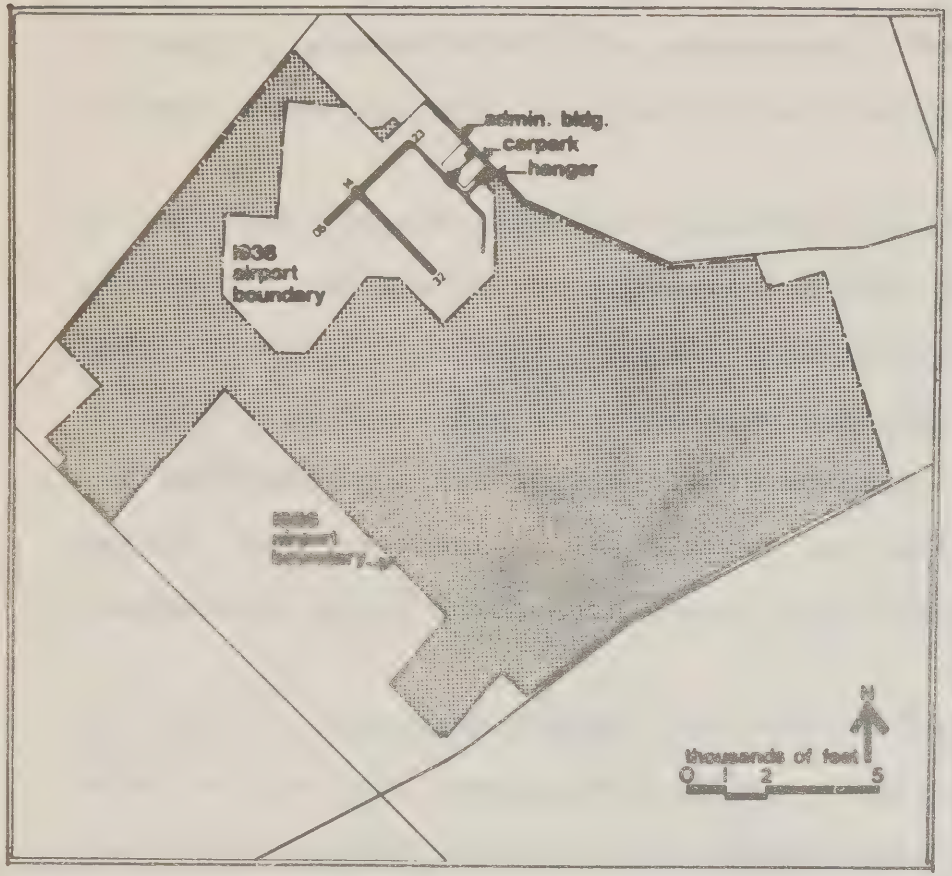
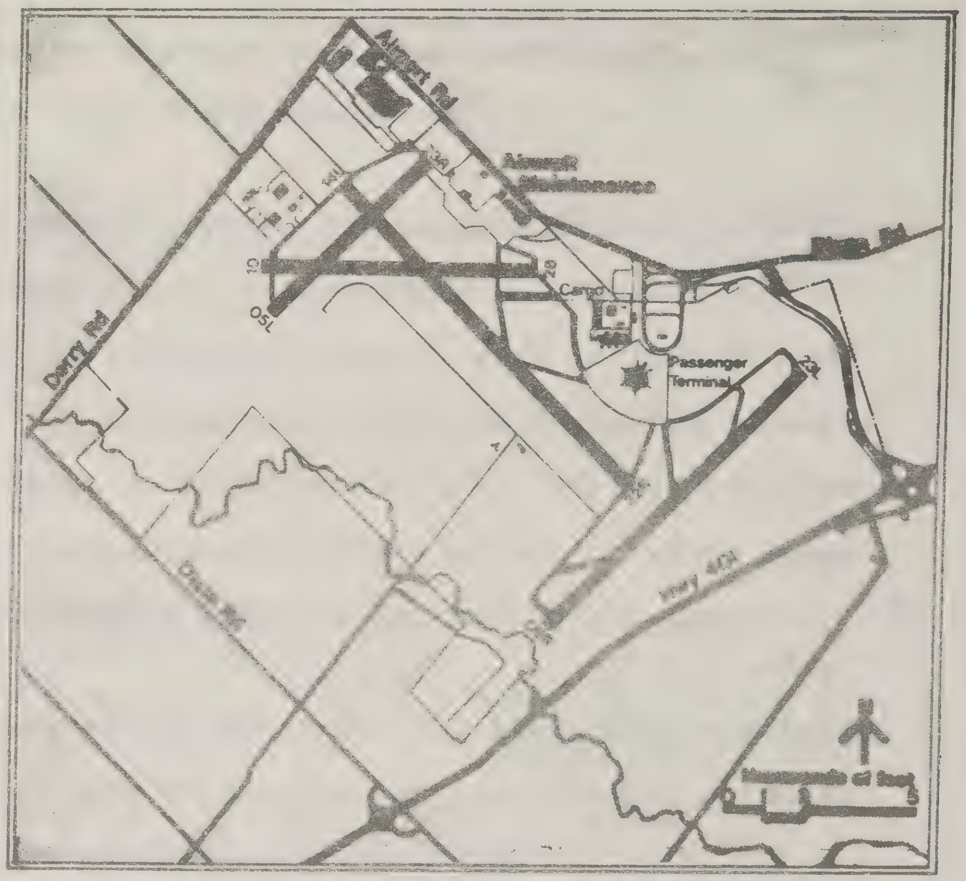


Malton Airport 1938



Malton Airport 1966

When Toronto's Malton Airport was opened in 1938, the largest passenger aircraft servicing it could accommodate only 14 passengers. There were fewer than ten scheduled aircraft movements per day and the area surrounding the airport was predominantly rural.

By 1966 the largest aircraft operating out of Malton carried 172 passengers and the number of aircraft movements had increased to over 200 per day, representing an increase of several thousand percent. During this period jet passenger aircraft were introduced and brought into operation in increasing numbers. To accommodate this growth, Malton Airport had expanded from its initial 1,400 acres to about 4,000 acres in 1968. During the 30-year period, land adjacent to the airport has undergone intensive urbanization including large residential areas which have proved to be incompatible with the increasing air traffic.

In light of this past growth, the Federal Department of Transport, in 1966, made a detailed study of the long range growth of air traffic of the Toronto Region and prepared a conceptual plan for the expansion of airport facilities. This resulted in the Malton Master Plan, 1967.

The plan demonstrated that air traffic, particularly long distance flights, would increase rapidly during the seventies and eighties as more of the public begin to take advantage of their growing opportunities for air travel.

It showed that to accommodate the forecast air traffic to 1986 and beyond, it would be necessary: to expand the airport boundary by acquiring significant acreage of adjacent land to accommodate more runways and terminal buildings; to increase the number of road lanes and to add transit facilities for access to the airport; and to expose more people and land to the effects of flight operations and, in particular, aircraft noise. Specifically:

- Notwithstanding the introduction of quieter engines and larger aircraft (which means that there would be fewer aircraft movements), the increase in air traffic would subject large existing and potential residential areas to high noise levels.
- Expansion beyond the existing airport boundary would occupy prime industrial land and new runways would expose more of the adjacent high density residential areas to aircraft noise.
- Although the highway network serving Malton is very extensive and additional capacity could be provided by the introduction of transit and further highway construction, it would be extremely costly to develop ground access facilities adequate for the 1980's and beyond.

Upon its announcement, this plan was loudly challenged by thousands of people who would be affected by such large scale disruption to existing and expanding residential areas.

Nevertheless, the plan established that the facilities at Malton could readily be expanded to accommodate the traffic of the 1970's within the existing airport boundary, and that this traffic would be adequately served by the access road network which was existing or being planned at that time. The area affected by noise would not increase significantly during the 1970's. The larger wide-bodied aircraft would each carry more passengers, thereby reducing the rate of growth in the number of flights. Technological improvements in engine performance promise quieter flights. The reduced rate of growth in flights and the quieter engines will limit the spread of noise during the seventies.

Given the social and economic benefits and therefore the inevitability of continued rapid growth in aviation, and because technological advances (including quieter engines and larger aircraft, and the emergence of other means of transport and communications) will not offset this growth, the daily lives of many people around Malton would be increasingly disturbed beyond the 1970's.

Therefore, in 1968 it was decided not to proceed with the full expansion of Malton and to establish a joint federal-provincial committee to develop a comprehensive aviation system for Southern Ontario and to study alternative sites for a second major airport for the Toronto area.

Since Malton can be expanded to accommodate the traffic of the 1970's without acquiring additional land and since a new major airport takes upwards of six years from site acquisition to opening date, it had been decided to proceed with an interim expansion of Malton to serve the traffic to 1978-79 (the earliest possible opening date of the second major airport).

Once the second airport is opened Malton will continue to play a significant role, for it will still be a convenient airport for many of the passengers in the region. It is possible that Malton's capacity may be further increased by anticipated changes in technology, on condition that such additional development will be contained within the existing boundaries, and will not entail an increase in the areas adversely affected by noise. Within these limitations the potential growth of Malton beyond the interim development program is expected to be modest relative to the greater part of the region's traffic which will be accommodated at the new major airport.

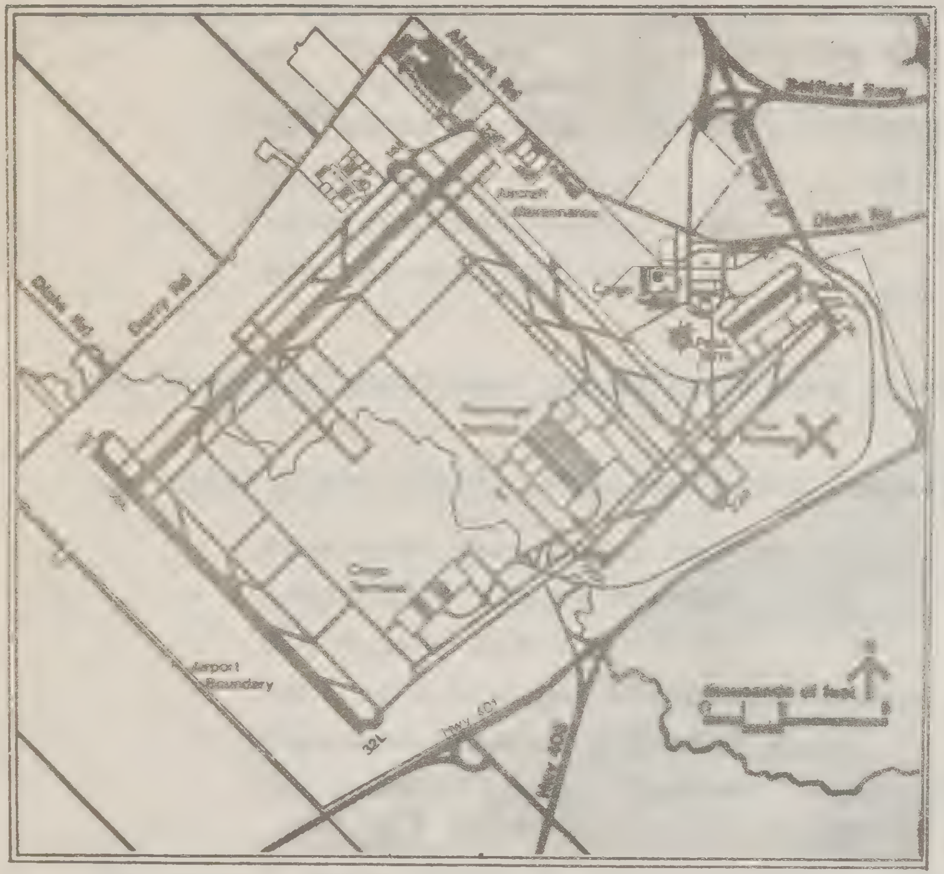
In 1966 the Minister of Transport commissioned a study to assess the extent of growth in aviation and to investigate the possibility of expanding Malton. The 1967 Master Plan was the outcome of this study. The plan was announced in the summer of 1968 and rejected by the Government of Canada in December of that year.

The 1967 Plan indicated that only by almost doubling the area presently occupied, to permit the construction of more runways and terminals, could Malton be expanded to meet the region's air transportation needs to beyond 1986. The viability of proceeding with this expansion relied on three important preconditions:

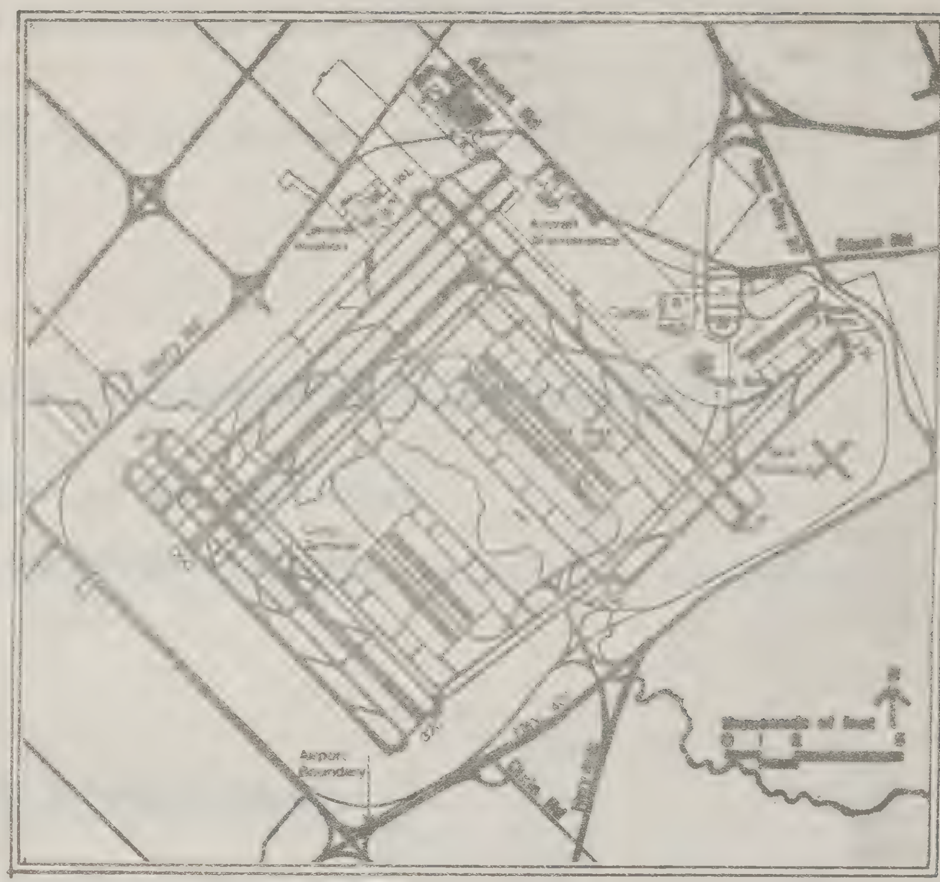
1. that additional land was available for expansion, taking into account planned and potential uses for other purposes;

2. that an adequate ground transportation system could be provided, taking into account existing highways and provincial plans for the future; and

3. that land use compatibility could be satisfied with respect to the communities surrounding the airport, taking into account potential conflict between existing and planned uses for the land and constraints on use which would result from flight operations.



1967 Master Plan · Phase 1 (to 1980)



1967 Master Plan · Phase 2 (ultimate development)

In December 1968, the Government of Canada decided not to proceed with this plan.

On the assumption that the three preconditions for expansion could be met, the suggested long range development plan made use of the following existing facilities:

- Passenger Terminal 1
- Two major runways 05R-23L and 14L-32R, and the shorter runway 05L-23R
- Cargo area
- Aircraft maintenance area
- General aviation area.

The proposed additional facilities were planned for construction in two broad phases.

The first phase (up to 1980) included completion of the following:

- Passenger Terminal 2 and part of an additional terminal
- Lengthened runway 05L-23R, and
- New runway 14R-32L
- Part of a new infield cargo area
- Expanded general aviation area
- Two possible short take-off and landing (STOL) runways

The second phase (ultimate development) included the following:

- Expanded passenger terminal facilities
- New runways 05C-23C and 14C-32C
- Expanded infield cargo area.

The construction of the proposed new runways, particularly those south-east of Etobicoke Creek, would have subjected large new residential areas around Malton to jet aircraft noise. Also, assuming it were possible to evolve a satisfactory technical solution to the ground access problem, the acquisition of additional land for the airport and access facilities would have further disrupted the adjacent communities.

Given that 70,000 persons already residing in the area would be disturbed by the development of the 1967 Plan, and given that this large number would increase further as a result of ongoing expansion of the adjacent communities, the Government of Canada therefore concluded that the precondition of land use compatibility could not be satisfied. Consequently, it decided against the full scale expansion of the airport at Malton.

Simultaneously with the decision to limit the expansion of Malton, it was recognized that additional facilities were needed to handle the region's rapidly growing air traffic until the opening of the second major airport. This interim development plan was developed to provide Malton with adequate capacity to the end of the 1970's.

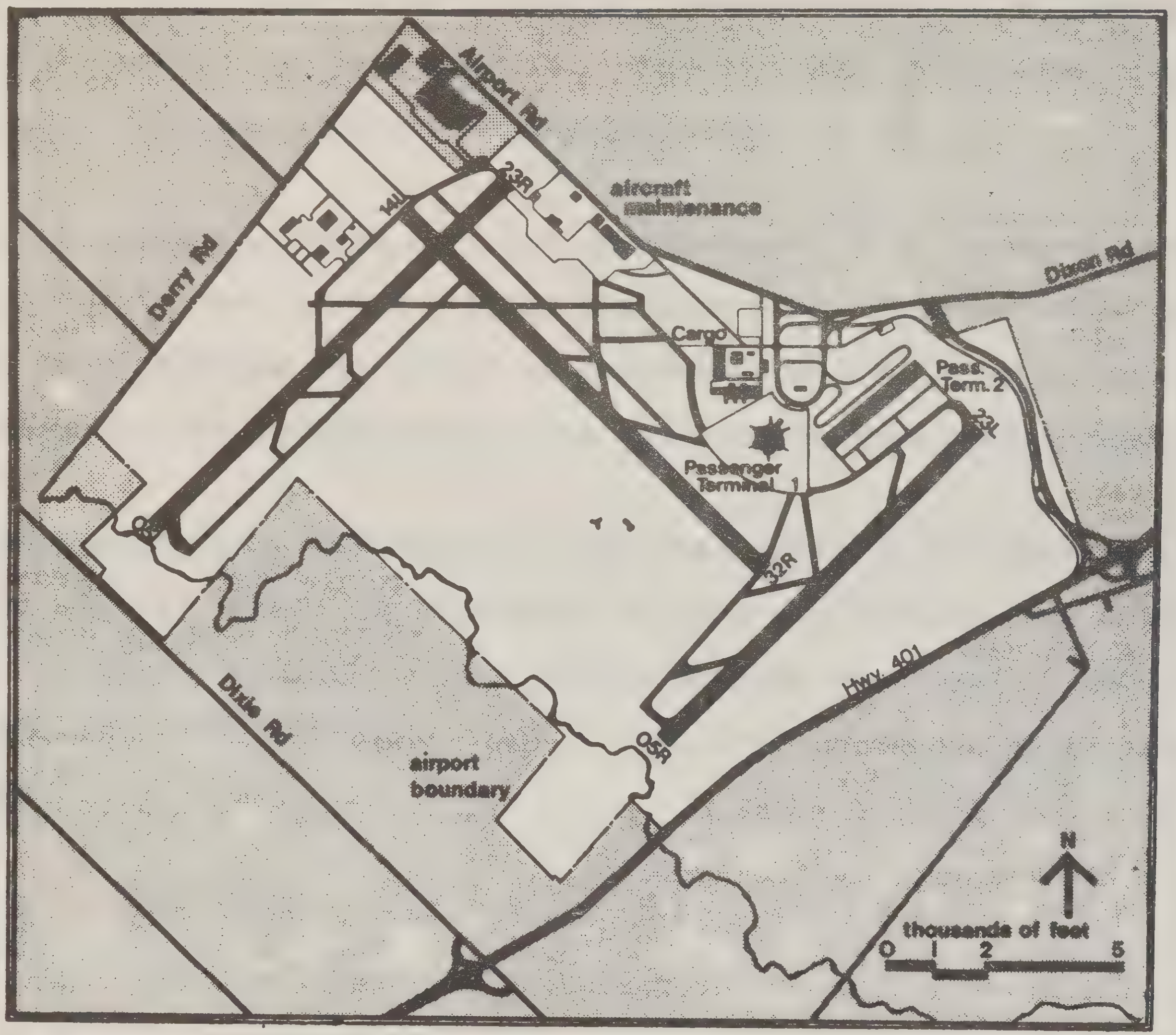
The interim development, which is partially completed, consists of the following elements:

- Passenger Terminal 2, in three stages, which is currently under construction. Stage I is scheduled to open in June 1972 and Stage II in 1973.

- The extension of runway 05L-23R and additions to the taxiway system, both of which have been completed.

- Improvements on a continuous basis to road access, parking capacity, air traffic control and existing passenger, cargo, general aviation and aircraft maintenance facilities.

In parallel with the construction of Terminal 2, a program to provide additional terminal capacity has been implemented. A temporary charter facility known as Terminal 3 commenced



Interim Development Plan

This plan is at present being implemented

operation in the summer of 1971 and succeeded to some extent in relieving pressure on Terminal 1 in the periods of peak traffic. This terminal is capable of processing three DC-8 or equivalent charter aircraft at any one time.

The capacity improvement program also includes processing of outbound charter passengers at hotels adjacent to the airport. These passengers are transported by bus directly to the aircraft, thus reducing the number of passengers and wellwishers using the terminals, the access roads and the parking facilities which serve them during heavy traffic periods.

The interim expansion plan, therefore, is one that provides for foreseeable airport needs up to the late 1970's, within the framework of land use controls now established. Moreover, it maintains flexibility for limited further expansion if technological development permits. The estimated cost of this interim airport development (from 1968) is $88 million.

As part of the study, Malton's potential capacity was examined to determine whether it was capable of playing a significant role in the region's commercial aviation system beyond the opening of the second airport, without increasing its property boundaries or necessitating further constraints on adjacent development.

The trend for quieter engines in new and larger aircraft is already evident. For example, the Boeing 747, Lockheed 1011 and the McDonnell Douglas DC-10 are all quieter than the Boeing 707 or McDonnell Douglas DC-8. The possible future development of advanced short take-off and landing (STOL) aircraft for shorthaul routes could reduce the area of noise-affected lands adjacent to airports.

The runway capacity of Malton is adequate to handle more than the anticipated aircraft movements which would be required to serve the 12 million passengers per year forecast for 1978. To handle a larger volume additional terminal facilities (beyond those currently planned) would probably be required and adequate access would have to be provided.

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Toronto area airports system

Toronto II Site Evaluation Methodology

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This is the second in a series of documents whose aim is to describe the development of the aviation plan for Southern Ontario. These reports:

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- discuss alternative sites for a new Toronto airport and describe the proposed aviation plan consisting of a Toronto Area Airport System and an Airport System for Southwestern Ontario;
- forecast the impact of anticipated future technological development on the design of the aviation plan.

This document deals with the procedures and investigations carried out to evaluate alternatives for the Toronto Airport System and sites for the new Toronto international airport.

All documents were prepared and co-ordinated by the Canadian Air Transportation Administration of the Ministry of Transport. The Province of Ontario assisted in the work discussed in this document through a joint Federal-Provincial Committee. A number of agencies both public and private assisted in the preparation of the aviation plan.

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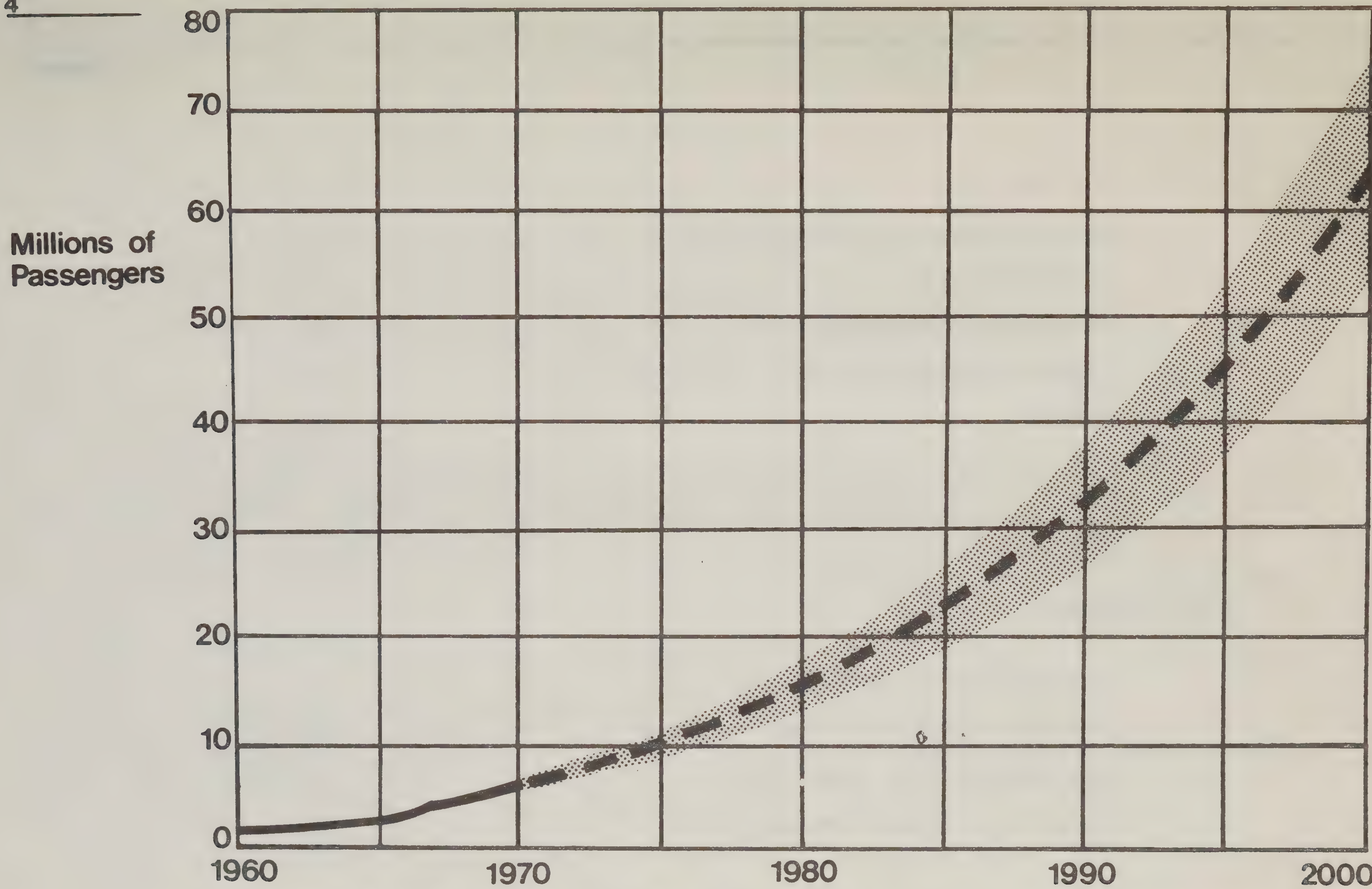


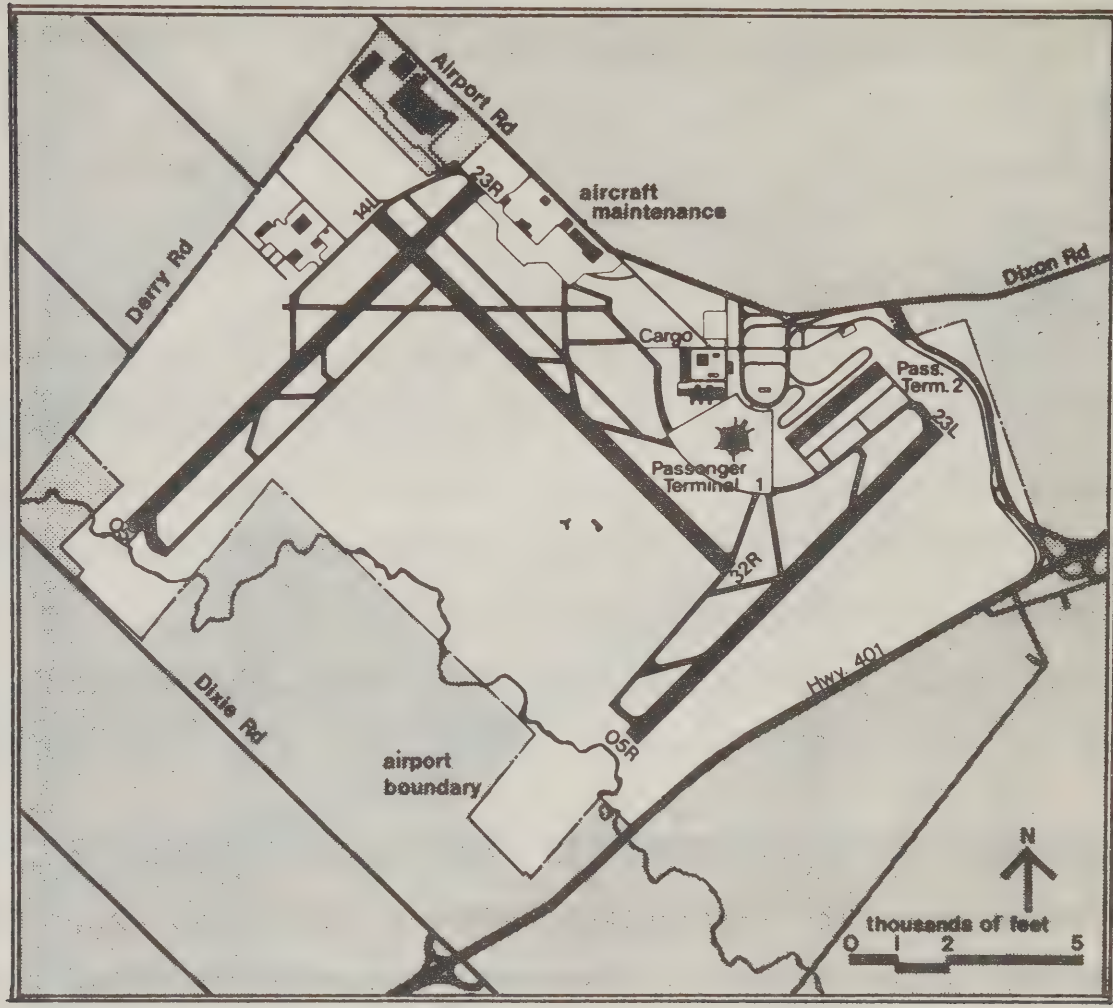
Growth of traffic in the Toronto area

- ± 10% uncertainty of mean projection

In light of the sustained rapid increase of air traffic throughout Southern Ontario, in 1966 it was decided to undertake a study of the long-term air transportation needs and of the way in which Malton Airport could be expanded to meet these needs.

Forecasts of air traffic indicate that the annual number of air passengers in the region could reach 60 million by the year 2000; i.e., nearly ten times the volume handled in 1971. The study resulted in the Malton Plan of 1967, and showed that to accommodate the forecast air traffic demands at the existing Toronto International Airport (Malton) it would be necessary to expand the airport boundary by acquiring a significant acreage of adjacent land to accommodate more runways and terminal buildings. It would also be necessary to increase the number of highway lanes serving the site, and to construct transit facilities in order to provide adequate access. Major expansion would also expose more people and land to the effects of flight operations and aircraft noise.

Therefore, in consideration of these factors and the very strong public representation, in December 1968 the Government of Canada decided not to proceed with the full expansion of Malton. A joint Federal-Provincial Committee was established to develop a comprehensive aviation plan for Southern Ontario, and to study alternative sites for a second major airport for Toronto. The system was to be planned to serve the region until the year 2000



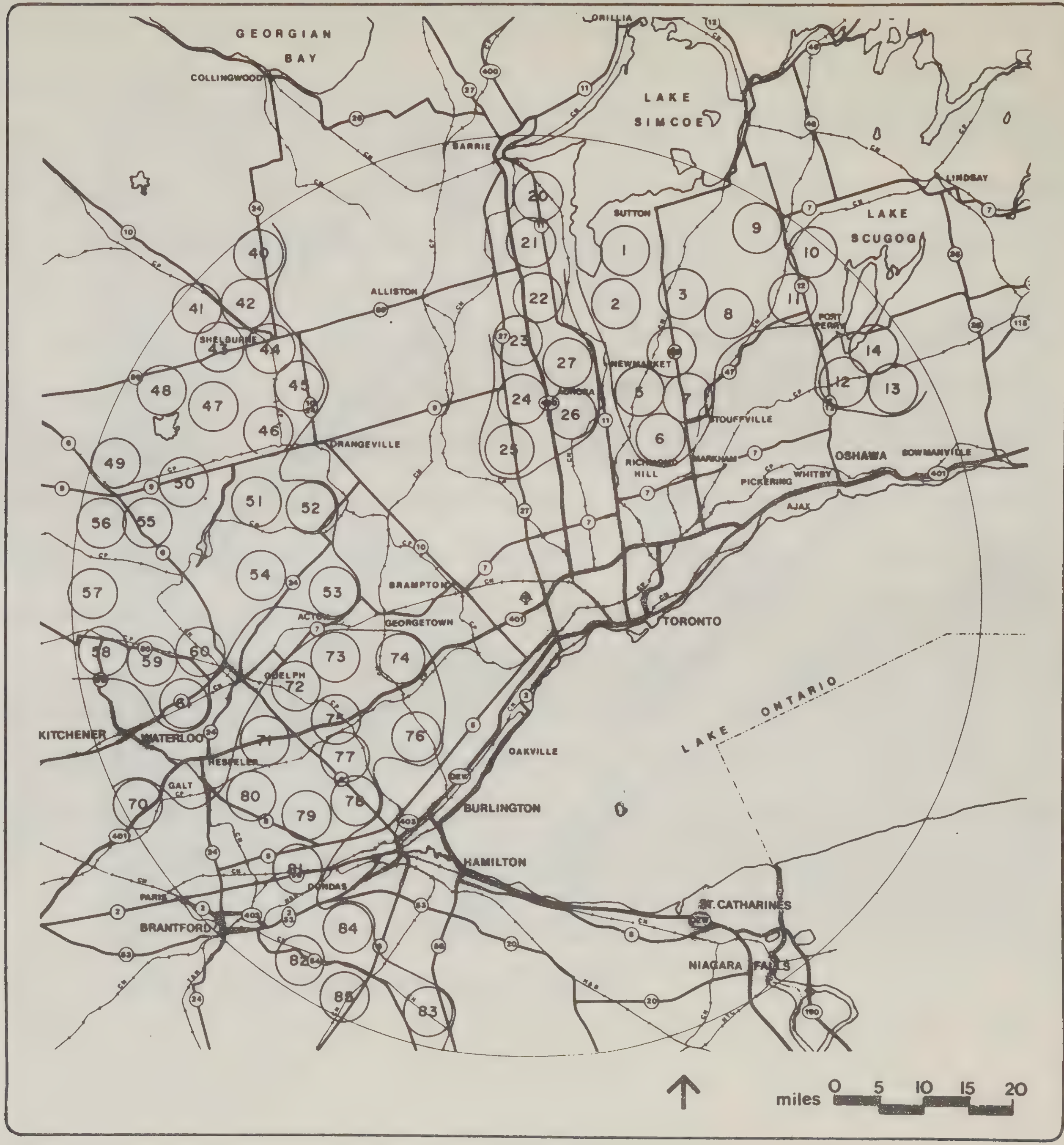
Interim development plan · Malton

and beyond, and was to be capable of responding to changes in patterns of air travel, patterns of urban/regional development (i.e. changes in the origin and destination locations of passengers) and new technologies (i.e. wide-bodied aircraft, STOL aircraft, and other advances more fully discussed in other documents of this series).

However, it was also shown that the facilities at Malton could readily be expanded to accommodate the traffic of the 1970's within the present airport boundary, and that this traffic would be adequately served by the road network which existed or was planned at that time. The area affected by noise would not increase significantly during this period. The introduction of wide-bodied aircraft and the promise of quieter engines would offset much of the effects of the short-term growth in the number of passengers.

Given the social and economic benefits and therefore the inevitability of continued rapid growth in aviation, and because the technological advances will not offset this growth in the long term, the daily lives of many people around Malton would be increasingly disturbed beyond the 1970's without a new airport.

Site Selection
Preliminary Sites



identification of potential sites

A principal component of the proposed aviation plan is a second major airport for Toronto. A planning team was formed and undertook the identification of potential sites as part of the preparation of the aviation plan. Site evaluation criteria were assembled by the Ministry of Transport with the co-operation of the Province of Ontario through the joint Federal-Provincial Committee. The criteria adopted relate to the specific requirements of the Toronto region while drawing on experience gained from similar studies elsewhere.

Potential sites were identified, first excluding all those land areas which were clearly unsuitable, according to the following four criteria:

- areas required to protect the airspace needed for safe operations at existing Instrument Flight Rule (IFR) Airports, particularly Malton;
- areas in which topographic features, such as marshy lands, or irregular terrain would render site development difficult and costly;
- areas of existing and planned urban development;
- areas that were too far removed in time and distance from downtown Toronto and from Malton Airport (initially a 50-mile radius was used as an appropriate guideline).

For the preliminary selection of alternatives it was assumed that the new airport should be capable of expansion to six runways. Based on these criteria, 59 sites were identified.

Site Evaluation Criteria

Progressively more refined evaluations were made to identify those sites showing the greatest potential for development. The criteria by which sites were examined are:

- safety and technical aviation considerations
- social and environmental effects (ecology)
- regional planning impact
- passenger convenience
- costs

Safety and Technical Aviation Considerations

The safety of air passengers is the paramount consideration in the choice of an airport site. The merits of the various sites from the point of view of safety and technical aviation were judged on the basis of:

SUITABILITY FOR AIR OPERATIONS AND AIR TRAFFIC CONTROL: Sites unsafe for flight operations were rejected.

OTHER FACTORS: Other criteria taken into consideration include delays and mileage penalties in avoiding flight path conflicts with overlapping operations of other airports; the effects of snow, fog and freezing rain, which would constrain flight operations; on and off site conditions which would adversely affect the operation of electronic navigational aids, and the possibility of bird strikes.

Social and Environmental Effects (Ecology)

SOCIAL DISRUPTION: The sites were compared in terms of the number of people living on properties which would be expropriated and the number of people who may be disturbed by aircraft noise. At each site the numbers of dwellings and community facilities affected were assessed. As the preferred site should disturb as few people as possible in the enjoyment of their property and recreational amenities, the effects on areas of recreational potential or of high scenic value were also considered for each site.

In this early stage of planning, the Government of Canada established the policy of ensuring the control of future development around the airport with a view to achieving compatibility between the use of adjacent lands and the effects of flight operations. The Canadian initiatives represent a new world standard in community and airport planning.

ENVIRONMENTAL AND ECOLOGICAL EFFECTS: The environmental impact of the airport construction and operation phases was examined, especially as these might affect run-off and stream regimes. Consideration was given to the anticipated degree of physical interference with natural habitat of wildlife. Particular attention was paid to determining whether any unique species would be affected, and also to the location of migratory bird flyways.

Regional Planning Impact

The Province of Ontario had initiated the preparation of a comprehensive plan for the growth of the Toronto Centred Region. The siting of a new major airport will have a significant and wide-ranging impact on the economic development of the region. A considerable number of people will be employed on the airport site itself. In addition, the construction of highways and rapid transit facilities to the airport and the provision of municipal services such as water and sewers in its vicinity may provide a catalyst for further economic development. The Government of Canada decided that the preferred site should support and complement the regional and urban planning goals of the Province of Ontario. This decision reflected the conviction that federal/provincial co-operation would ultimately result in the maximum economic and social benefit from each public dollar invested.

Passenger Convenience

The time and expense of passengers travelling to and from the airport were considered in comparing the sites. The level of convenience associated with each site has been measured in terms of distance to the site, time spent in travelling to and from the site, and possible conflicts with existing traffic patterns. Studies were made of the transportation systems required to provide access to the sites.

Costs

The estimated cost of developing each site, consistent with providing a viable and convenient airport system, was determined. The two types of costs considered in the evaluation were:

- Airport construction, operating and maintenance costs, and
- Ground access capital costs.

The costs associated with developing and operating an airport at each of the site alternatives were developed on a phased basis for the period from 1971 to 2000, on the assumption that the airport could be opened in 1978. These costs, and interest on the investments involved were then accumulated both to the year 1990 and the year 2000. This calculation takes into account the interest payments which would be incurred if comparatively high investments have to be made in the early years.

Selection of 4 Sites

The studies on the site were therefore part of a more comprehensive effort to design an aviation plan. An initial phase of the site studies was undertaken in 1969/1970. At that time four sites, each as representative of a different zone, were selected for further scrutiny. These sites were:

- the West site - between Guelph and Milton
- the Northwest site - near Orangeville
- the North site - just south of Lake Simcoe
- the East site - just south of Lake Scugog

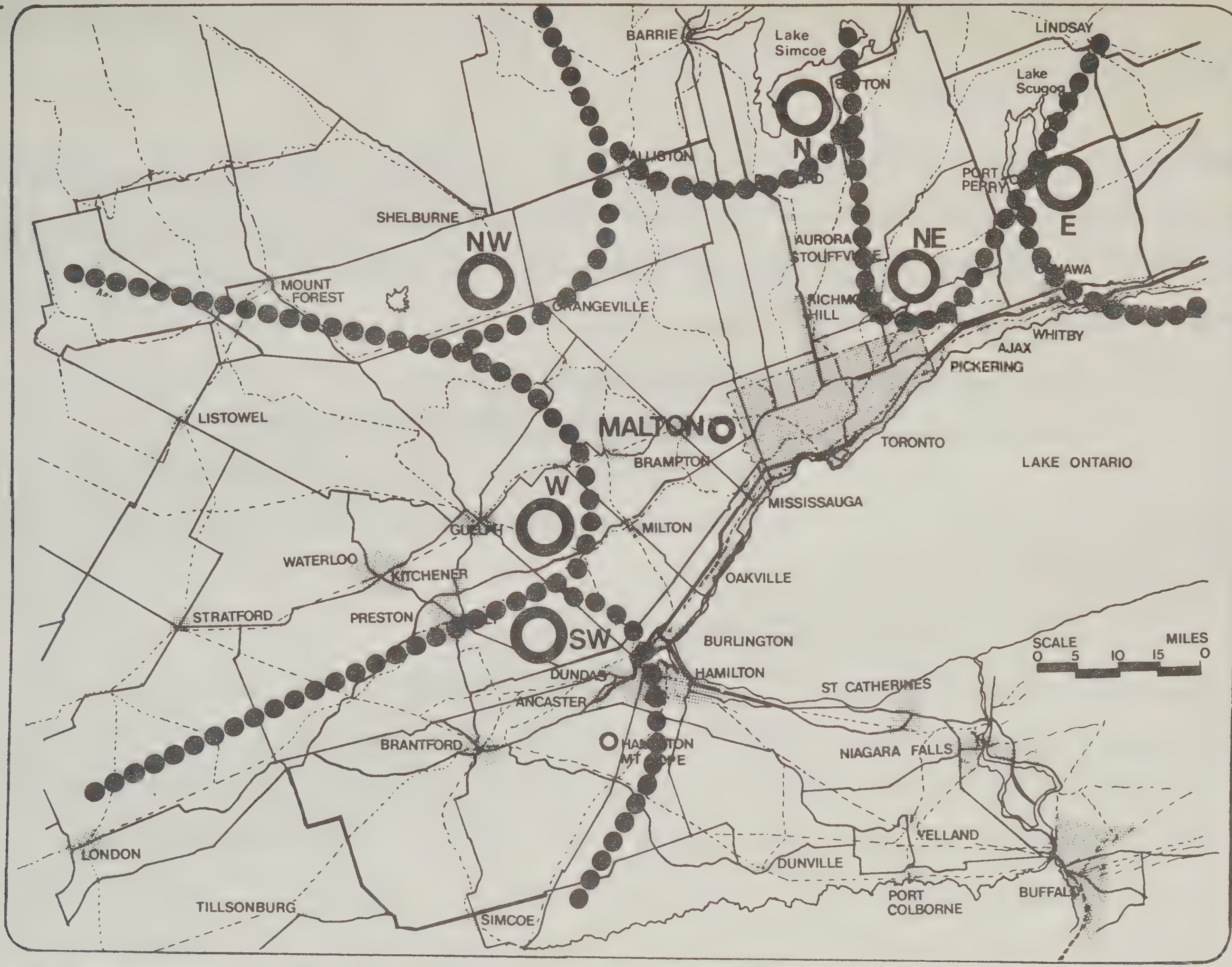
Aviation Plan

While these sites were being examined the study of the aviation plan which would best serve Southern Ontario was continuing. This showed that because the region is so widely extended in a northeast-southwest direction, that two airport systems - a Toronto Area system and a system for Southwestern Ontario - would meet the air travel needs of each of the two regions better than a single new airport. In such a plan the new international airport would require a maximum of four runways only, partly because a significant amount of the traffic within Canada and to the U.S.A. would be handled by other airports in the system.

Review of Potential Sites

Because of this reduction in the number of runways required at the new international airport, it was decided to review the potential sites available to determine whether any other sites should be included in the detailed evaluation. As a result it was decided to include two additional alternatives in the final evaluation. These sites were:

- the Northeast site - north of Pickering
- the Southwest site - at Peters Corners.



Best site in each geographic region radiating from Metro Toronto

Six sites, which were the best in each of six geographic regions radiating from Toronto, were therefore subjected to a comparative evaluation. These sites were:

- the West site - between Guelph and Milton
- the Northwest site - near Orangeville
- the North site - just south of Lake Simcoe
- the East site - just south of Lake Scugog
- the Northeast site - north of Pickering
- the Southwest site - at Peters Corners.

After serious consideration, the Federal-Provincial Committee decided to exclude the North and West sites. The North site was rated unacceptable because:

- a very large number of people would be disturbed, especially during summer holidays when flight operations are at a peak;
- the airport would disrupt prime recreational areas.

The West site was eliminated from further consideration because it:

- would cause severe interference with flight operations at Malton;
- conflicts with the Toronto Centred Region Plan of the Province of Ontario.

The Evaluation of Sites

The four remaining sites were evaluated in detail by reference to the five principal site evaluation criteria:

SAFETY AND TECHNICAL AVIATION CONSIDERATIONS: The operational availability of the Northwest site would be markedly reduced by severe storms which occur in the winter season. The East site would also be affected but to a lesser extent. The Southwest and Northeast sites proved to be fully consistent with safety and technical considerations.

SOCIAL AND ENVIRONMENTAL DISRUPTION: All sites occasion some disruption to the existing population and to the natural environment. However, at all of the sites the population in the immediate vicinity is relatively small and no major communities will be affected by expropriation or unacceptable noise levels. Selection of the Northwest site would adversely affect the recreational use of the Niagara Escarpment. At the Southwest site, it was feared that the development of the airport and the flight operations might endanger the natural character of the Beverly Swamp. The East site would disturb the important recreational area around Lake Scugog. The Northeast site is preferred since: most of the land has been cleared for cultivation, most of the land is no longer used for farming, the site area is on high ground with the water table being controlled by the adjacent creeks; no unique wildlife, vegetation or geographic formations will be destroyed.

REGIONAL PLANNING IMPACT: The Northeast and East sites support the Province's regional planning strategy of providing a major stimulus to development east of Metropolitan Toronto and structuring development along the Lakeshore Corridor. The development of the Northeast site also coincides with the phasing of the Province's Design for Development Plan. The Northeast site has a further advantage in that it can readily be connected to Malton via the multi-use service transportation corridor (Parkway Belt) that is adjacent to both.

PASSENGER CONVENIENCE: The Northeast site is most convenient to the travelling public in the Metropolitan Toronto area. It is the closest to the city centre and is well located to serve that area of Metro which is less well served by Malton at the present time. The East site is distant both from Malton and the city centre and is hence the least convenient. The Northwest is also distant from the city centre, and lacks a market base for short-distance flights. The Southwest is more convenient than the East or Northwest, but is still considerably farther from Metropolitan Toronto than the Northeast. (Air travellers from Southwestern Ontario will be conveniently accommodated by the announced Southwest Airport System specifically designed to meet their needs).

The distances of the alternative sites from the centre of Toronto and from Malton on the existing highway network are shown below:

	Malton	Northeast	Southwest	Northwest	East
Distance from city centre (miles)	20	30	52	59	58
Distance from Malton (miles)	-	35	48	47	63

COSTS: Airport and ground transportation capital and related operating and maintenance costs were estimated for each of the sites. Although the costs of individual items vary from site to site, the total costs of the Northeast, Southwest and Northwest sites are essentially equal. However, the Northeast site has the advantage that because of its relationship to Lake Ontario and to a number of major transportation arteries, and because the facilities required for its development may be integrated with those already planned by the Provincial Government as part of the Toronto Centred Region Plan, economies can be achieved. The East site is significantly more expensive to develop than the other three because a large initial investment in ground transportation facilities would be necessary to guarantee access to the airport, particularly at those times when recreational traffic is at a peak.

The Northeast site is the best location for a new international airport to serve Toronto and its environs. The principal drawbacks of the other sites are as follows:

- The Southwest site - danger of ecological disruption of the Beverly Swamp.
- The Northwest site - frequently severe climatic conditions; no local passenger market.
- The East site - severe climatic conditions; far from the centres of travel demand; significantly larger development costs.

The Northeast site was selected for the following reasons:

1. It is fully consistent with safety and other aeronautical considerations.
2. Although close to Toronto, population in the immediate vicinity of the airport is relatively small. No major communities will be seriously affected by expropriation or unacceptable noise levels and environmental impact is minimized.
3. It supports the development plans of the Province of Ontario by providing a major stimulus to the east as set out in the Design for Development for the Toronto-Centred Region and coincides with the phasing of investment.

4. It is the closest of all to the city centre, and most effectively complements the airport at Malton in serving the present and future population of Metropolitan Toronto.

5. Its relationship to Lake Ontario, existing transportation corridors and facilities proposed by the Province of Ontario will lead to economies in the provision of water, sewage, transportation access and other facilities.

The Northeast site thus met the established criteria more completely than the alternatives.

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CEMETERIES

Since the joint Provincial-Federal announcement of the new Toronto international airport, there have been a number of inquiries regarding existing cemeteries within the future operational area of the airport. The Toronto Airport Team is aware of this important concern and will, as far as possible, exclude cemeteries from the operational area, but this will not be possible in all cases.

The airport land as presently defined includes eight cemeteries of various sizes and denominations. Several are located close to the edge of the airport land and it appears likely that the boundary lines can be adjusted to exclude them. The remaining cemeteries which will be affected by the construction of airport facilities, or which cannot be excluded from the airport area proper, may have to be relocated.

The relocation of cemeteries in Ontario is the responsibility of the Consumer Protection Division of the Provincial Ministry of Consumer and Commercial Relations. When a cemetery is to be relocated an Order-in-Council to close the cemetery is made by the Province of Ontario, and published for public information. After a 4-week waiting period, a second Order-in-Council is made announcing the

exact relocation of the cemetery. A further waiting period of 2 weeks must elapse before the first graves are moved. These waiting periods are designed to give the public adequate notice of the intention to relocate a cemetery and to enable them to obtain further information regarding the closure and relocation of the cemetery. Should the next-of-kin wish to have the deceased reinterred in a location other than that selected by the Province, this may also be arranged.

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HISTORICAL SITES AND THE NEW TORONTO AIRPORT

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HISTORICAL SITES

Public concern has been expressed about the future of buildings that are of historic interest which may be affected by the construction and operation of the new Toronto international airport.

The investigations conducted during the evaluation of the Northeast site showed that no buildings or sites of recognized and well known historical significance would be disturbed by airport construction. It was realized, however, that within the area affected there are some buildings which are of interest from two viewpoints:

1. Being typical of their type in terms of architecture and/or construction.
2. Being typical of their type in that they illustrate the way in which people lived at selected times during the development of Southern Ontario.

The Historic Sites Division of the National and Historic Parks Branch of the Department of Indian Affairs and Northern Development is currently working in the region of the Pickering site. The survey in the vicinity of the new airport will help to determine to what extent any of the buildings and sites of historic significance may be affected by the construction and operation of the airport.

Action to preserve historic buildings which are acquired will be determined on an individual basis in consultation with the Historic Sites Division, the Ontario Heritage Foundation and other interested groups and individuals.

Where possible, buildings will be left undisturbed and arrangements will be made for them to be managed in the public interest. If airport construction necessitates their removal, or if the effects of flight operations would prevent their enjoyment, the Ministry of Transport will seek to arrange for their relocation, possibly in the new North Pickering Community Development Project.

Both Federal and Provincial Governments will work together to ensure that our heritage is preserved.

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THE ECONOMIC IMPACT OF THE NEW TORONTO AIRPORT

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ECONOMIC IMPACT

Introduction

Aviation generally has been growing extremely rapidly throughout the last two decades, and especially since the introduction of large jet aircraft into commercial service. Growth in the Toronto area parallels that of other large urban regions in North America and in Europe, and is now of major significance to the economy.

The expansion which has taken place in the past, first in business traffic, but more recently in recreational travel both within Canada and to and from foreign destinations, has resulted in the creation of large numbers of jobs. At the present time the air transport industry employs over 10,000 persons directly in the Toronto area and total employment including the indirect and induced effects exceeds 30,000. Over the next fifteen years these figures are expected to more than double.

By 1986 it is estimated that more people will be employed at the new Toronto airport than at Malton. As a high quality employer itself, and one which will attract other development, the new airport will provide an important stimulus to the eastern part of the Toronto-Centred Region and this will be reflected in increased prosperity in Oshawa, Whitby, Ajax and Pickering.

[illegible]

[illegible]

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[illegible]

[illegible] and planning.

Airport Impact

The impact of the airport will begin to be felt as land acquisition commences. Over one thousand workers will be engaged in the construction of the airport. Others will be employed in the construction of roads, municipal services (water supply, sewers, etc.), housing and other urban facilities. The demands of the airport for high quality services and the similar requirements of adjacent urban developments will help to make the provision of these services more economic and viable at an earlier date.

The build-up of employment at the airport is expected to commence several years before the airport is commissioned in 1978/79. The total number which will be employed at both Malton and the new airport at the time of opening is expected to be over 20,000, and this will have risen to almost 40,000 by 1986. The actual jobs will depend on the role of the airport, because the number of employees required depends not only on the volume of traffic but upon its type. With one possible role, i.e. all international and some domestic and transborder traffic at the new airport, employment at that airport could exceed 50% of the total at the two airports by 1986.

Studies of other major airports show that in addition to substantial hotel development, three principal types of industry - chemical production (especially pharmaceutical), electrical and electronic goods, and assembly and manufacture of machinery - favour locations near major airports. This trend has been shown to exist in the Toronto Region by analysis of the establishments around Malton. It is therefore anticipated that as the new airport develops, and especially in view of the industrial locations which will be planned and serviced in association with the airport, additional employment will be attracted to the East.

It is estimated that over two-thirds of the employees who will work at or in the vicinity of the new airport will live in Pickering, Ajax, Whitby and Oshawa. These workers will help to establish a broader base to the economy of the area, which will in turn support an improved level of retail and service industry functions throughout the whole Dunbarton/Oshawa corridor. Each job actually created on the airport site will add four to six additional people to the population of the area.

Conclusions

1. The on-airport employment at the new Toronto airport will be substantial, and will increase rapidly once the airport is opened and traffic grows.

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[illegible]

[illegible]

2. Industries and commercial ventures attracted to the airport will add to the employment in its vicinity.

3. Because two thirds of the employees who work on or near the airport are expected to live in the Pickering-Ajax-Whitby-Oshawa area, the demand for retail and service facilities will be increased. The anticipated economic growth combined with broader employment base will support a higher level of services than at present.

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ECOLOGY AND THE NEW TORONTO AIRPORT

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ACKNOWLEDGEMENT

The information contained in this summary has been extracted from reports of studies undertaken by the Province of Ontario and is used with their permission.

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ECOLOGY

The ecological impact of the new airport development has been studied by the Federal and Provincial Governments. An important criterion in the site selection process was the evaluation of the ecological consequences of constructing and operating an airport.

I - The Present Condition

The site is primarily agricultural, almost 90% having been cleared for cultivation. However, much of the land is no longer being farmed and some is being redeveloped for other purposes. Of the remaining land, about half is meadow and half is woodland. The woodlots that exist tend to appear unmanaged and to be of poor quality. There are no County forests.

Five soil series, comprising for the most part loamy shales, clay loams and gravely sandy loams are represented in the area. The soils and other factors characteristic of the site qualify it as class 1 agricultural land.

Most of the site is drained by the West Duffin Creek, with a small area included in the drainage basin of the Little Rouge Creek. These streams have their source in cold water springs in the Oak Ridges moraine to the north, but by the time the waters have reached the site, they have warmed considerably, becoming a less favourable habitat for fish. By the time both streams reach the site they are no longer suitable for trout, although occasionally some are taken.

The relatively high runoff rate associated with the rolling topography of the site has been increased by clearing of the original forest area for agriculture. As a result, flooding has been a problem in the lower reaches of Duffin Creek since the early 1830's.

The wildlife inhabiting the site include ruffled grouse, cotton-tail rabbits, European hare, groundhogs and racoons. White-tailed deer have been recorded but are not common. Bird nesting and feeding habitats are extremely limited in the area, and although the migratory routes of duck and geese pass over the whole of Southern Ontario, these birds do not concentrate in this area.

To indicate the nature and potential of land with respect to wildlife, the Ontario Land Inventory ratings measure both

(a) use suitability, which is the ability of an area in its present condition to support wildlife, and

(b) use capability which is the potential of an area to support wildlife.

The present suitability of the site for wildlife is poor to fair. While there exists a higher wildlife capability, it would require decades of intensive management to return the area to its natural state that this potential might be realized.

In summary, the agricultural nature of the site means that there no longer exists the naturally balanced set of ecological inter-relationships that was the case before the site had been developed for agricultural purposes. It exhibits no particular or unique ecological characteristics that are not found in abundance elsewhere. From an ecological viewpoint, the site is typical of the urban fringe.

II - Impact of the Airport

To fully appreciate the nature of the impact of an airport development on the ecology of an area, two characteristics about airport construction should be understood. First, airports are land extensive rather than land intensive. This means that although a large area is required for an airport site, only a small portion of that site is actually affected by construction (i.e. for runways, terminal facilities, and airport services).

Secondly, the airport development proceeds by stages. The construction period for each stage is also measured in years; therefore, the impact of the airport construction is spread out over a longer time period than would normally be the case for, say, residential development. Each stage is also preceeded by an extensive planning period, at which time the ecological impact can be thoroughly assessed and measures to prevent possible adverse effects designed into the construction program.

While the potential impact of an airport development on the ecology of an area is less than might be thought, it has been the subject of careful study by both the Provincial and Federal Governments. The impact has been evaluated in terms of the effects on air, water and soil, vegetation and wildlife, and is described below:

Air

As explained above, the areas affected by construction will be comparatively small. The dust which will result from earth moving will be no greater than that at any typical construction site, and is unlikely to be noticed at all outside the airport site.

Once operations commence, the air pollution associated with flight operations will be minimal. Less than 2% of total air pollution comes from commercial aircraft at present, and aircraft activity is not a major contributor to ground level air pollution in the immediate vicinity of airports.

Aircraft engine manufacturers are also constantly seeking to improve their emission control devices. For example, the newly developed smokeless combustor, currently being introduced, reduces jet engine pollution by two-thirds compared with a decade ago.

Water and Soil

The land upon which the runway terminals and other facilities will be constructed is separated from the surrounding area by deep valleys. Any lowering of the water table which might result from reduction in soil capacity due to construction will therefore be confined to the airport site.

Water and Soil

The airport drainage system will be designed to handle the increased run-off which may result from the paving of runways, aprons, roads, etc. The construction of a carefully designed drainage control system may also reduce the flooding hazard downstream from the new Toronto Airport. During construction, measures will also be taken to ensure that soils do not erode and cause silting of drainage channels.

Vegetation

During construction of the airport, the maximum use of the existing topography on the site will be made to reduce the amount of earthworks required. Major valleys will, as far as possible, be left unlevelled, thus preserving the small areas of woodland which are found, for the most part, along the edges of the creeks. The Ministry of Transport will carefully preserve vegetation in stream and creek valleys to the extent that this can be achieved without creating hazards to flight operations.

Wildlife

Because the natural vegetation will be preserved wherever possible, existing wildlife habitat will be affected to a minimal extent. The existing wildlife population is small in number, and since the construction

of the airport will occur over a period of several years, and the surrounding region contains ecological conditions similar to those on the site, it will be comparatively easy for animals which are disturbed to seek new locations.

Conclusions

The natural ecological systems of the site for the new Toronto airport have already been radically modified by its development for farming. Only a small portion of the original vegetation and woodland cover remains, and the suitability of the site for supporting wildlife is limited.

The airport site and the surrounding area have been on the threshold of development for urban purposes for a number of years. The site is no longer truly rural. Farming productivity is down and individual farmers have moved when presented with a satisfactory offer for their land. At the time of the announcement of the airport, development for urban purposes appeared imminent.

The airport will permit the preservation of what is left of the natural ecological system in the area.

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EXPROPRIATION PROCEDURES

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Expropriation Procedures

The expropriation procedure to be used in acquiring the site for Toronto's new international airport is set out in the new Federal Expropriation Act.

At the time of the airport announcement on March 2nd, Notice of Intention to Expropriate the proposed site was registered on behalf of the Minister of Public Works in local Registry and Land Title Offices. Titles are now being searched so that all persons with an interest in the land concerned can be properly identified.

Once this step has been completed, all persons with an interest in the land to be expropriated can be notified by registered letter. Thereafter, Notice of Intention to Expropriate can be published in the Canada Gazette. During the ensuing 30 days, any objections to the intended expropriation must be made in writing to the Minister of Public Works. In the following 30-60 days, Hearing Officers appointed by the Attorney General of Canada will conduct public hearings for the purpose of recording such objections.

At the conclusion of the hearings, the Minister of Public Works will consider the reports of the Hearing Officers. After due consideration, Notice of Confirmation to Expropriate can be registered.

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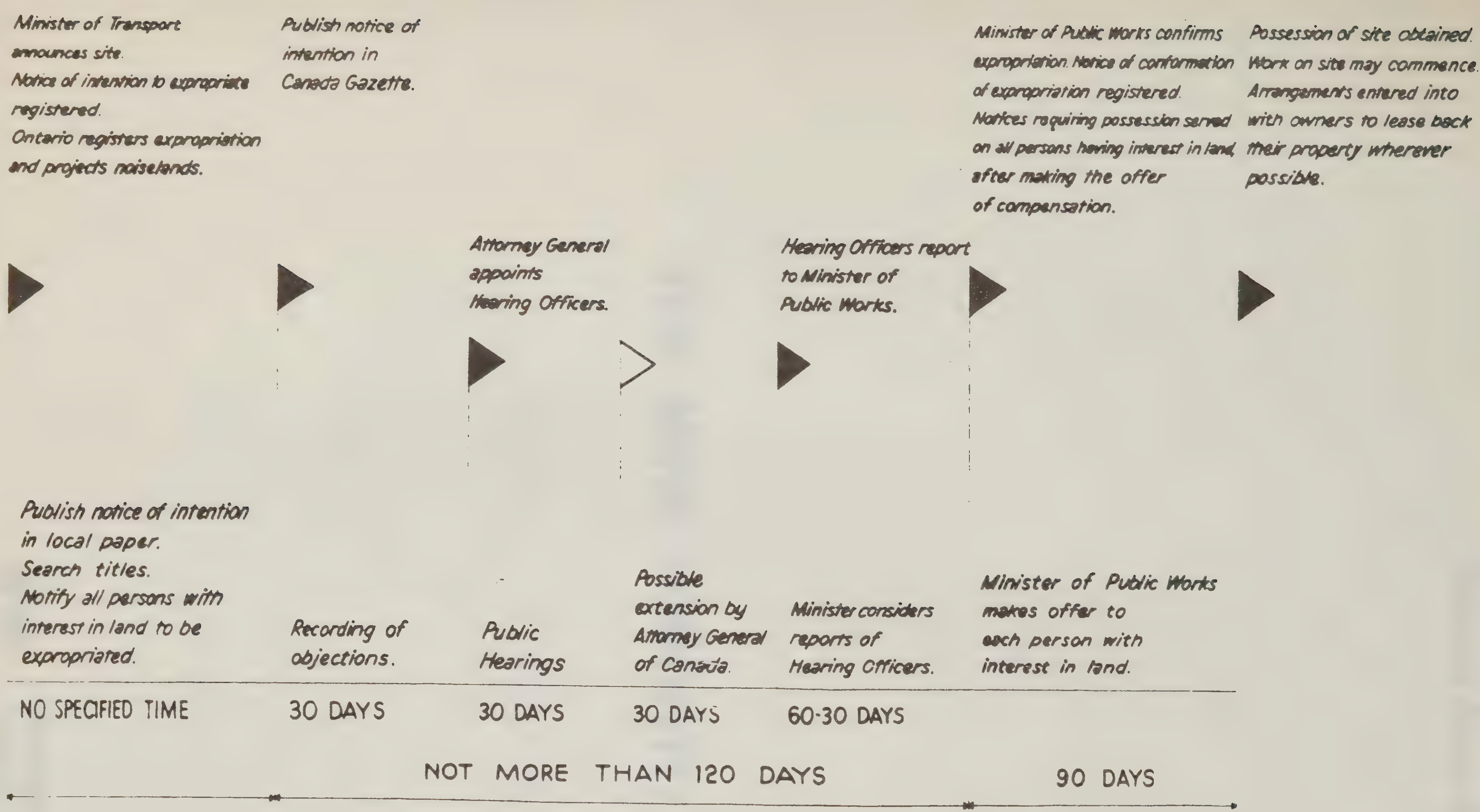
The Act contemplates that within 90 days of registering the Notice of Confirmation, individual offers of compensation will be made to each owner. The Minister is only entitled to take possession once an offer has been made and a notice requiring possession has been served on those having an interest in the property, specifying a minimum of 90 days prior to possession.

It is emphasized that the great majority of residents will have the opportunity of continuing occupancy under reasonable rent-back arrangements. The few residents who will be requested to move in 1973 will be informed as soon as possible after the expropriation is confirmed.

The new Expropriation Act ensures that no one will suffer financial burden as the Act provides for payment for equivalent accommodation, a home for a home, including market value plus costs, expenses and possible losses arising out of relocation.



ESTIMATED TIMING OF EXPROPRIATION PROCEDURES TO POSSESSION OF SITE

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FARMING

The new Toronto Airport is located in a region which had been developed for agricultural purposes. Over 90% of the land has been cleared for cultivation.

Today, less than 50% of the land is occupied by owner/farmers. Land prices in the area are a reflection of development potential rather than value for farming purposes.

The whole area has been defined as Class 1 Agricultural Land in the Canada Land Inventory, and is potentially capable of high productivity. The Federal Government will encourage farming to continue wherever possible, since this use of land is for the most part compatible with flight operations.

For the purposes of planning for on-going farm operations the land is divided into three categories:

1. That land required over the next 2 - 5 years for construction purposes, which can be farmed until needed.
2. That land which will be incorporated within the operational area when the airport opens (about six thousand acres).
3. The balance of the acquired land, which may continue to be farmed for 15 or more years.

The Toronto Area Airports Project Team is currently preparing a master plan of the airport runway layout, terminal locations, access roads and other facilities. On the basis of this plan and the construction schedule Federal officials will be able to advise farmers which land will be affected by airport construction (category 1) and airport operations (category 2) and the dates at which the land will be required.

All farmers affected by the acquisition of land for the airport will be compensated in full whether or not they wish to continue farming. Moreover, those farmers who wish to take advantage of the opportunity to continue farming may lease back their farms from the Government at modest rates. Others wishing to farm may make similar arrangements should uncommitted lands be available.

Noise from flight operations will not adversely affect many types of farming. However, some farming operations do attract large numbers of birds, which can be hazardous. As flight operations will not commence before 1978/79, there will be ample time to introduce any changes necessary over an extended period, after full discussion between the farmers affected, the Ministry of Transport and both Federal and Provincial Departments of Agriculture.

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Nuclear Power Plant

With the selection of the Pickering area for the site of a new airport, questions have been raised concerning the possible dangers that might exist in the event of a crash at the Pickering nuclear power station. In order to appreciate that there is no risk it is necessary to understand just what a nuclear power plant is and how it works.

There are basically two main ways to generate electricity. The most common way is to divert falling water through a turbine like a water wheel, causing it to rotate and turn a generator which produces electricity. A good example of this type is at Niagara Falls. Where a source of falling water is not available, a turbine rotated by steam pressure is used. To produce this steam, some sort of fuel is needed. Coal, oil and natural gas are the most common fuels with coal being the most widely used. The problem with these fuels is that they are expensive to transport, they require expensive pollution control devices and most important, they will become exhausted if present demands for electrical power continue. As an alternative to using these fuels, nuclear power plants were developed. The nuclear fuels used are cheaper than fossil fuels for an equivalent amount of energy output and their low bulk makes them easy to transport. Canada has one of the largest uranium reserves in the world so exhaustion of supplies will not be a problem for many, many years.

The process by which heat is generated in a nuclear plant is called a chain reaction. To get a chain reaction, uranium dioxide pellets are sealed in metal tubes and bundles of these tubes are inserted in a large tank called a reactor. When these fuel bundles are surrounded by a liquid called heavy water, a chain reaction takes place. Heavy water, also called deuterium oxide, occurs in ordinary water at the rate of one part in seven thousand. In a chain reaction, some of the uranium atoms give off neutrons which if slowed down by a moderator such as heavy water will strike other uranium atoms causing them to split. This splitting results in a great release of heat energy and several more neutrons which will cause more atoms to split. The heat energy is used to make steam which turns the turbine connected to the power generator. The chain reaction is controlled by adjusting the level of the heavy water or by lowering control rods of cadmium which absorb the neutrons readily.

The one by-product of this process which causes most concern is radioactivity. Extensive precautions are taken to assure complete safety for the public and station personnel. The reactor building is constructed of specially coated concrete four feet thick. Pressure in the building is maintained below that outside so that air would tend to flow in rather than out in the event of a leak. Inside the reactor building is a structure of walls and floors up to four feet thick. The heart of the reactor is a stainless steel cylinder contained in a heavy concrete box with walls between four and eleven feet thick. The resulting radiation released from the

plant is very small. Natural radiation we receive from the sun and other sources is at least sixty times stronger than that emitted by a nuclear power plant.

To ensure safe operation, the Pickering plant has a triplicated protective system. Computers control and monitor all regulating mechanisms. The reactor can be shut down in a matter of seconds in the event of any malfunctions. Continuous monitoring ensures that no effluents, liquid or gaseous, are released with unsafe levels of radioactivity.

A key part of the plant's containment system is the vacuum building. The reinforced concrete walls of this building are three feet thick and the roof is two feet thick. An internal concrete frame structure consists of columns four feet in diameter and horizontal beams two feet wide and four feet deep. The four reactor buildings are connected to the vacuum building by a reinforced concrete pressure relief duct. In the event of an accident in any of the reactor buildings, pressure relief valves will open to relieve excess pressure through the ducts. The vacuum building can contain all the steam that would be produced by the loss of the entire primary coolant.

A large water reservoir provides a dousing spray to condense this steam when the pressure rises beyond a certain point. Therefore, in the event of any conceivable accident to the reactor or heat transport system all the energy that could be released is contained inside the structure itself.

When the uranium fuel is used up, the spent fuel bundles are transferred by conveyor to a storage bay where they are stored under 26 feet of water. This bay is lined with fourteen inch thick reinforced concrete walls specially treated to prevent leakage. If seepage were to occur, the water would be drained to manholes for cleanup and returned to the bay. The storage bay has a capacity for forty-two reactor years' fuel bundles and is located in the reactor auxiliary bay. In short, the utmost effort has been put into the design of the nuclear plant to ensure that there is the least possible danger to the public.

A few remarks should be made about the mistaken conception some people have concerning the possibility of an atomic explosion in a damaged nuclear reactor. While there is a fundamental similarity between the nuclear reactions in atomic weapons and commercial reactors, a reactor can never explode with the violence of an atomic bomb.

First of all, a different type of fuel is used. A nuclear reactor uses natural uranium which contains about 0.7 per cent by weight of uranium 235, the isotope that takes part in the chain reaction. An atomic weapon uses highly enriched fuel with about 90 per cent uranium 235 by weight. As described before, natural uranium requires a moderator for a chain reaction. Enriched uranium requires no moderator.

A second major difference is in the rate of reaction. The release of energy in an atomic weapon takes place in a very short interval of time. This accounts for the violence of the explosion. The energy in a reactor is released over a relatively long interval of time and is in the form of useful heat.

A third difference in the two processes is the effect of temperature on the rate of reaction. The release of heat in an atomic weapon chain reaction speeds up the reaction thus producing more heat and a still faster reaction. On the other hand, the chain reaction of a reactor will be slowed down by an excess of heat.

In conclusion, although both atomic weapons and commercial reactors employ chain reactions, the nature and

and magnitude of the energy released are very different; the former resulting in uncontrollable destructive energy; the latter in useful controllable heat energy.

The proposal to locate the new Toronto airport in the Pickering area raised the question of whether or not this might create unnecessary risks in regard to an aircraft accident at the nuclear power plant. The chances of a major air crash happening anywhere are very small, as Canada's air safety record will show. The majority of crashes that do occur take place in the immediate vicinity of the airport during takeoff or landing. In this regard it should be noted that the power plant is about ten miles from the airport site.

However, what would happen if somehow a plane did get completely off course and at the same time suffered some major structural damage causing it to crash into one of the reactor buildings? When the Pickering plant was designed, the safety assessment submitted to the Atomic Energy Control Board took into account the possible effects of an earthquake on the plant's structure. The tremendous shocks of an earthquake would have substantially more effect than an air crash. For instance, a large projectile such as an engine might penetrate the thick reinforced concrete walls of the reactor building but having penetrated two feet

of reinforced concrete it is inconceivable it would then be able to penetrate the special, very dense four to eleven feet thick concrete walls of the reactor vault. The worst result of the reactor building's walls being penetrated would be a complete loss of coolant. However, the safety system is already designed to handle such a situation and would immediately respond by sucking the entire contents of the system into the vacuum building and activating all emergency systems.

It is apparent from the representative runway layout that the flight path will be more than five miles east of the Pickering station. Thus the likelihood of an air crash at the Nuclear Power Plant will not be increased by the new Toronto airport. While the odds are very much against a crash no one can deny it could happen and that the possibility exists with or without the new airport. Even if this should happen and involve the largest jets in existence today there is absolutely no danger because of the design criteria which were established to guard against the effects of earthquakes.

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Off-Shore Airport Concepts

The possibility of building airports over water rather than on land has been suggested as a means of minimizing community disturbance, avoiding the use of land suited to other purposes and enabling an airport to be located closer to the urban centre.

The presence of Lake Ontario required that the feasibility of a major off-shore airport to serve the Toronto region should be studied. Such an airport would have to be located far enough from the shore for noise not to be a problem to the community.

Types

Two types of off-shore airports have been identified:

1. A sufficiently large off-shore installation to permit all or most of the present type of airport activity, including passenger ticketing, baggage handling, vehicle parking and cargo processing.
2. A smaller installation sufficient for aircraft handling but with the majority of other airport activities occurring at the shore-based installation located at the end of the connecting access causeway.

Construction Methods

There are four methods of constructing an off-shore airport:

1. The fill concept. An embankment is placed directly on the under-water foundation and brought up to a finished elevation sufficiently high above the water surface to prevent waves over-topping.

2. The pile concept. A deck structure well above water level is supported by piles or caissons.

3. The floating concept. Some form of cellular construction is erected which provides sufficient buoyancy to support a deck structure by flotation. This system includes adequate mooring and hydraulic equipment to control the movement and level of the structure.

4. The dike and polder concept. A dike is constructed completely enclosing an area which is later drained of water. The drained area would be below the elevation of the surrounding water.

Technical and Cost Considerations

The cost of constructing an off-shore airport would far exceed that of a mainland airport. Preliminary estimates for capital construction of the structure, not including terminal facilities and access, are in the order of $1 billion. Most of this sum would have to be committed for the initial phase, further increasing the costs by the accumulation of interest over a longer period of time.

Access to an off-shore airport would also be more costly and technically more difficult. The costs are aggravated by the required concentration of all transportation links to the airport into one, or at the most two very high capacity channels. The on-shore support facilities and transportation interchanges would have to be located on lakeshore land, further isolating the city from the waterfront.

Weather conditions could have a restrictive effect on the off-shore airport concept. Fog is more prevalent over the Great Lakes than over the adjacent land areas and could reduce the capacity of the airport.

Implications

In view of its physical and operational problems and high cost, the construction of a major airport in Lake Ontario could not be contemplated at this time. Although a major off-shore airport does not look feasible at present, this does not preclude the possible construction of an off-shore airport for STOL aircraft. A STOL airport could be smaller, could be located closer to shore and, therefore, would not have the same disadvantages as a major airport. Fog could continue to be a problem.

Government
Publications

Toronto Area Airports System
April 21, 1972

PASSENGER AND CARGO FORECASTS INCLUDING METHODOLOGY

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ENQUIRIES

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SUMMARY OF FORECASTS

TORONTO AREA AIRPORTS PROJECT

BACKGROUND

On December 20th, 1968, the Minister of Transport announced that the Federal Government had decided against expansion of the Toronto International Airport at Malton to handle the total aviation needs of the Toronto area, that a second airport would be developed in the late 1970's, and that TIA Malton would continue in operation as an air carrier airport. In due course a conceptual plan for a multi-airport system was established. The Toronto Area Airports Team was formed to determine the requirements for the new facilities, to outline the roles of the airports in the system and to recommend an appropriate schedule for implementation.

For a major airport planning program, reliable forecasts of future traffic volumes are indispensable. They are used as an aid in determining the capacity of the facilities to be constructed and when these will be required. Forecasts of future passenger and cargo traffic at TIA were prepared in 1967 as part of the Master Plan for Toronto International Airport. Since the public announcement of the new airport system plan in 1968, several additional traffic volume forecasts have been prepared using more recent information and more comprehensive techniques.

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The purpose of this document is to review the passenger and cargo forecasting techniques that have been used by the Project Team and to summarize the results obtained.

AIR PASSENGER AND CARGO FORECASTING

Forecasting forms an essential ingredient of nearly all planning operations. The forecasting of passenger and cargo traffic has been accomplished in many different ways by different people, although generally in the final analysis modifications are incorporated based on informed judgements of the forecasters. All of the techniques have in common a heavy reliance upon past data and, therefore, there is an implicit assumption that major socio-economic conditions over the forecasting timeframe will be somewhat similar to those experienced over the past years for which data are available; that is, there will be no world war, no major depression and no sudden and contrary shifts in consumer preferences.

Forecasts of air passenger and cargo traffic, then, are prepared by examining the historic growth of each and projecting this growth into the future. A very simplistic approach to projecting growth assumes that the past trends will be maintained. A more realistic approach is to develop relationships between the growth of travel by air and certain economic and demographic indicators such as population growth,

gross national product, disposable income, etc., and use these relationships in the development of forecasts. Studies have been done to show that these relationships are valid for all modes of transportation, including air transportation.

The analysis of Toronto passenger traffic in the 1960's as recorded by the Aviation Statistic Centre, indicates the following average annual growth rates:

PASSENGER SECTOR	AVERAGE ANNUAL GROWTH RATE IN TORONTO PASSENGER TRAFFIC FROM 1960 - 1969
Scheduled flights with Canadian points	10.0%
Scheduled flights with United States points	13.0%
Scheduled flights with other international points	17.8%
Charter Flights	39.3%
AVERAGE GROWTH	13.7%

If the simplistic approach is used and future passenger traffic is projected solely on the basis of these past unconstrained growth rates, the volumes for 1985 and beyond become unrealistically large. For example, international traffic grew in the 1960's at such a rate that a simple extrapolation would yield an absurd 690 million international passengers at Toronto by the year 2000. Before such a volume as this is reached, it is obvious that the rate of growth will decelerate to a much lower level. Thus, where interrelationships between air passenger traffic and certain socio-economic factors can be identified, they provide much more realistic results. For instance, there is a definite limit on the amount of time and money available for air travel and this must be recognized during the forecasting process.

Studies of the substantial growth of air passenger traffic in the 1960's showed several key interacting considerations:

- greater discretionary income
- greater propensity to travel by air
- reduced travel costs
- shorter travel times with the advent of longer range and faster aircraft
- improved service through extended bilateral agreements

Evidence of the impact of these factors on air travel is the dramatic growth in Canada in the leisure market and in recreational travel and the corresponding increase in international travel.

A recently conducted analysis of leisure time showed that the average hours worked per week by private, non-agricultural wage and salary workers in the United States dropped from 58.5 hours in 1900 to 41.2 in 1961. In addition, during the last 30 years of that period, there was a marked increase in the incidence of paid annual vacations and a sharp rise in the number of holidays taken per year. Since 1961, the trend has continued and is anticipated to continue further in increasing leisure time in several ways. We see movements toward a seven-hour day, a four-day week, a one-month vaction and earlier retirement; all of which result in more time for travel.

In addition to this increase in leisure time, several socio-economic and other factors can be related to the growth in air passenger activity. During the 1960's the number of air passengers tripled which was substantially greater than the growths in population and G.N.P. This growth in air travel can be attributed to a great extent to the decline in air fare prices over the period coupled with the increase in personal disposable income. However, over the long-term it is anticipated that there

is a lower limit to which air fare prices will fall as well as a declining rate of increase in the propensity to travel. Thus it is anticipated that the rate of growth in air travel will decelerate to approximately the long-term forecast growth rate of the economy; that is, about 5 per cent increase per annum in G.N.P in real terms. Table 1 outlines the long term air passenger growth factors used in the Toronto forecasts and shows the continuing deceleration in the annual growth rates.

In preparing the forecasts used by the Toronto Team, the more comprehensive approach to forecasting was used. The forecast growth rate, based on the trends of the previous few years, was modified to reflect the anticipated effects of changes in socio-economic and other factors.

PASSENGER FORECASTS

SUMMARY OF TORONTO PASSENGER FORECASTS

Four passenger forecasts have been used on the Toronto Airport Project. Table 2 summarizes the results from these four studies. The first study does not include data for charter passengers at Toronto. Insufficient statistics on this segment

TABLE 1

FORECAST ANNUAL AIR PASSENGER GROWTH RATES TO 2000

FOR TORONTO

PASSENGER FLIGHT SECTOR

	Scheduled Flights With Canadian Cities	Scheduled Flights With American Cities	Scheduled Flights With International Cities	Charter Flights	Average Growth
Actual 1960's	10.0%	13.8%	17.8%	39.3%	13.7%
1971-75	7.5%	10.2%	11.7%	20.0%	10.5%
1976-80	6.5%	8.8%	10.1%	15.0%	9.3%
1981-85	6.1%	7.1%	8.1%	12.0%	8.0%
1986-90	5.7%	6.1%	6.4%	10.0%	7.1%
1991-95	5.3%	5.3%	5.3%	10.0%	6.7%
1996-2000	5.0%	5.0%	5.0%	10.0%	6.4%

TABLE 2

TORONTO AIRPORTS PROJECT

SUMMARY OF ANNUAL TORONTO PASSENGER FORECASTS
(MILLIONS OF PASSENGERS)

YEAR	1st Forecast (Dec. 1969) (No charter incl.)	2nd Forecast (Sep. 1970)	3rd Forecast (May 1971)	4th Forecast (Jan. 1972)
1970	5.3		6.3	6.3
1975	8.0	9.9	10.2	9.2
1980	11.7		15.5	15.9
1985	16.4	18.7	22.4	23.2
1990	21.6	28.6	31.1	32.5
1995			42.7	44.8
2000		66.4	58.5	61.9

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[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]			[illegible]
[illegible]	[illegible]	[illegible]		[illegible]

were available at the time of its preparation to permit meaningful forecasts. The charter estimates in the last three forecasts are not separated from the totals as the nature of this market has been changing quite rapidly and is anticipated to change even further, so that identification of it as a separate total is not considered meaningful.

From the comparison of the four forecasts shown in Table 2, it can be seen that the updates of the original forecasts using more recent actual information and more detailed techniques do not change the results substantially.

COMPARISON WITH OTHER MAJOR AIRPORTS

Table 3 shows the air passenger forecasts for Toronto to 1980 as compared with forecasts prepared for Montreal and several major United States cities. The data are shown in terms of millions of total estimated passengers and the number of times the volume of passengers in each year will increase over the base year 1965. Actual figures are shown for both 1965 and 1970 for each city. As can be seen, the forecast growth in passenger traffic for Toronto is quite comparable with those shown for the other major centres.

TABLE 3

COMPARATIVE FORECAST INCREASES IN PASSENGER MOVEMENTS

TORONTO VS. OTHER NORTH AMERICAN CITIES

1965-1980

City	Year	Millions of Passengers *	Times 1965 Passengers	Annual Per Capita Resident Round Trips (1970)
Toronto	1965	3.3	1.0	
	1970	6.5	2.0	0.41
	1975	10.2	3.2	
	1980	15.5	4.8	
Montreal	1965	2.6	1.0	
	1970	4.6	1.8	0.37
	1975	8.3	3.2	
	1980	12.0	4.6	

New York	1965	23.2	1.0	
	1970	36.7	1.6	0.60
	1975	53.4	2.3	
	1980	89.1	3.8	
San Francisco	1965	8.2	1.0	
	1970	16.9	2.1	1.02
	1975	25.6	3.1	
	1980	44.2	5.4	
Chicago	1965	17.4	1.0	
	1970	27.6	1.6	0.92
	1975	41.0	2.4	
	1980	68.0	3.9	
Atlanta	1965	6.7	1.0	
	1970	16.4	2.5	2.99
	1975	26.4	3.9	
	1980	44.8	6.7	

New Orleans	1965	2.2	1.0	
	1970	3.9	1.8	0.94
	1975	6.2	2.8	
	1980	10.5	4.8	
Los Angeles	1965	12.2	1.0	
	1970	21.3	1.8	0.54
	1975	30.2	2.5	
	1980	48.9	4.0	
Dallas/	1965	5.2	1.0	
Ft. Worth	1970	10.6	2.0	1.15
	1975	16.9	3.3	
	1980	29.4	5.7	
Boston	1965	5.2	1.0	
	1970	9.2	1.8	0.74
	1975	14.0	2.7	
	1980	23.3	4.5	

Washington/	1965	9.2	1.0	
Baltimore	1970	14.9	1.6	0.77
	1975	21.5	2.3	
	1980	34.1	3.7	

* Passenger volumes shown for 1965 and 1970 are actual figures/

It should also be acknowledged that the precise definition of the market or "catchment" areas served by major airports is difficult. However, studies have shown that the majority of passengers at airports come from the principal Metropolitan areas close to the airports. An analysis of the trips generated at these airports, expressed as annual resident passenger round trips per person living in the defined market areas, gives an indication of the propensity to travel by air in each market. As part of Table 3, we have shown this analysis for 1970 for each city. As can be seen, this trip generation rate is substantially lower in both of the Canadian cities, when compared to the American counterparts. However, the propensity to use air travel in Canada may pick up substantially so that it approaches that of the American cities. If this should happen, the passenger traffic shown in the current Toronto forecast could be somewhat understated.

AIR CARGO FORECASTS

Air cargo forecasting is particularly difficult. Both the demand for air cargo and the availability of aircraft are difficult to assess. For instance, a mix of freighter aircraft plus the belly capacity of passenger aircraft is used to carry cargo. However, if the available cargo proves to be too much for the belly space available, it may not be practical to use

freighter aircraft and the demand may be satisfied by other modes of transportation.

Four forecasts of air cargo have been used by the Toronto Airports Project Team. The first three forecasts were prepared on the assumption that G.N.P. and other socio-economic factors used would have the same modifying effect on cargo growth rates as on passenger growth rates. The fourth study was specifically related to cargo and demonstrated that this assumption produced optimistic results. Thus, the new forecast resulted in substantially lower estimates.

SUMMARY OF CARGO FORECASTS

Table 4 summarizes the results of the four cargo forecasts used by the Toronto Airports Project. As can be seen, the first three forecasts show essentially similar results for the years indicated, while the last forecast estimates substantially lower results, particularly in the later years.

TABLE 4

TORONTO AREA AIRPORTS PROJECT
SUMMARY OF ANNUAL TORONTO CARGO FORECASTS
(MILLIONS OF POUNDS)

Year	1st Forecast (Dec. 1969)	2nd Forecast (Sept. 1970)	3rd Forecast (May, 1971)	4th Forecast (Jan. 1972)
1970	198	-	227	224
1975	441	-	508	492
1980	1,005	-	1,155	999
1985	-	2,100	2,456	1,868
1990	4,600	4,800	5,260	3,089

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April 21, 1972

THE NEW METROPOLITAN TORONTO ZOO AND THE NEW TORONTO AIRPORT

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Effect of the New Toronto Airport on the New Metropolitan Toronto Zoo

The new 700 acre Metropolitan Toronto Zoo is located in the rolling country of the Rouge River Valley. Its first phase is scheduled to be completed in 1973. The zoo will eventually display thousands of rare species in a natural setting.

Many of these animals perceive noise differently from humans. Exposure to sounds which they do not normally encounter may lead to disturbed behaviour patterns. The planners of the Toronto Area Airport System considered this possibility in evaluating the proposed sites for the second major airport. The important facts are:

1. The nearest point on the boundary of the site chosen for the new airport is more than six miles from the location of the future zoo.

2. The runway orientations are such that aircraft will not fly near the zoo on approach or departure.

3. The flight paths do not cross the zoo and are never closer to it than seven miles.

4. Airport operations at this distance will be inaudible over the normal level of noise in the zoo area.

Major zoos in other cities have been located at approximately the same distance from their respective airports. The Assiniboine Park Zoo in Winnipeg is not more than one mile from the end of the runways and aircraft do overfly this important zoo both on arrival and departure. The famous San Diego Zoo is located less than three miles from Lindbergh Field Municipal Airport and is in the proximity of two naval air stations. In Europe, the renowned zoos of Frankfurt and Amsterdam are approximately seven miles from the Frankfurt and Schiphol Airports respectively. All these zoos are thriving and are unaffected by aircraft operations.

Therefore, the new Toronto airport will not adversely affect the new Metropolitan Toronto Zoo.

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Toronto Area Airports System

May 4 , 1972

AIR QUALITY AND THE NEW TORONTO AIRPORT

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AIR QUALITY

The current public concern over the increasing pollution of the environment has raised questions about the contribution made to this problem by jet aircraft. Studies in the U.S. have shown that on a nationwide basis less than 2% of the total air pollution comes from commercial aircraft. Comparable studies in Canada indicate that the figure is even less. However, there is still uncertainty over whether the area in the immediate vicinity of an airport has concentrations of pollutants which are unacceptable. For this reason an air quality survey was carried out at the request of the Department of Transport in the vicinity of the Toronto International Airport by the Air Management Branch of the Ontario Department of Energy and Resources Management to compare the actual pollutant levels with established air quality objectives. The survey was carried out over one year from November 1968 to November 1969, to cover all types of weather conditions.

The principle pollutants emitted by aircraft are particulate matter, hydrocarbons, carbon monoxide, nitrogen oxides and sulphur oxides. These exhaust smoke particles are non-toxic. The smoke, however, is offensive to look at and can cause local soiling and reduced

/2

visibility. Hydrocarbons and nitrogen oxides can react in sunlight to produce haze. Carbon monoxide and oxides of nitrogen and sulphur can be either irritant or toxic or both in sufficient concentrations.

To carry out the air quality survey, sampling stations were located near the village of Malton, on Airport property and in the Borough of Etobicoke. These stations were positioned in line with the runway used most often by jet aircraft. A number of different measuring techniques were used. These are described below.

Measurement of Particulates

Three different techniques were used to measure particulates:

(i) Soiling Index:

An air sample is drawn through a paper tape filter for a specified length of time. When light is transmitted through this filter, the reduction in intensity caused by the presence of particles is a measure of their concentration. The annual average concentration was found to be well below the Ontario objective. In addition, no 24-hour average concentration exceeded the quality objective established by the Government of Ontario. Only 3% of all the observations made exceeded this objective.

(ii) <u>High Volume Sampler</u>:

A large volume of air is passed through a glass fibre filter which is weighed before and after to determine the amount of deposit collected. For all but one station, the measured concentration exceeded the quality objective established by the Government of Ontario. This was expected as measurements in most Ontario cities exceed this standard. However, analysis of several samples indicated that on the average, only 10 percent of the total suspended particles could be of aircraft origin. Therefore, it was concluded that concentration of deposits is caused by the urban activity generally.

(iii) <u>Dustfall</u>:

This is measured by exposing open-mouthed cylindrical containers for 30 days and analysing the contents. Measurements indicated that the quality objectives established by Ontario for a monthly reading and for an annual average were exceeded at the stations located on Airport property but were met at

those outside except for one month at the Etobicoke site. Again, however, analysis indicated a low proportion of the dustfall came from aircraft emissions.

Measurement of Gaseous Pollutants

(i) Total Hydrocarbons:

Measurements of hydrocarbon concentrations showed that both average and maximum readings at all stations were lower than readings taken in downtown Toronto. Further, only a portion of the lower amounts measured were attributable to aircraft.

(ii) Carbon Monoxide:

Measurements were taken only at the Etobicoke station from July to November 1969. All hourly-average readings were well below the quality objective established by the Ontario Government.

(iii) Sulphur Dioxide:

Sulphur dioxide readings made at the Etobicoke station were also low, with only 2 of the 2529 hourly-average reports above the quality objective established by the Government. Jet aircraft would contribute only a small proportion of these readings.

The Air Management Branch concluded from this survey that aircraft activity was not a major contributor to ground level air pollution during the measurement period from November 1968 to November 1969. However, it did recommend that airlines install newly developed smokeless combustors to eliminate the offensive black smoke which is the cause of most citizen complaints and which does exceed the Ontario standard for smoke colour from stationary sources. Airlines are having the modification done as part of the regular engine maintenance work. This program should be completed within the next year.

The aircraft industry, fully aware of the need for improvement, is developing the necessary technology for reducing the pollution contribution made by aircraft

engines. The smokeless combustors mentioned above not only reduce the offensive smoke output but decrease the total emissions by 24%. The jet engines of a decade ago produced nearly three times the emissions of these improved engines. It is anticipated that improvements will continue.

The air quality in the neighbourhood of an airport is dependent not only on the emission from the aircraft but also on the frequency of operations. The introduction of the new airport will assist. The traffic will be less concentrated at any one location, thereby reducing the concentration of pollutants.

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BIRDS
AND THE
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BIRDS AND THE NEW TORONTO AIRPORT

The safety of air passengers is a paramount consideration in the choice of an airport site. Consistent with this consideration is the minimization of disruption to the national environment including the effect on wildlife and birds. Accordingly, an important criterion in the site selection process was the evaluation of the possibility of collisions of birds with aircraft.

Studies demonstrate that the area around Metropolitan Toronto is not a major migratory route or flyway. The charts in the accompanying Appendix indicate the migratory flyways within Canadian airspace together with the periods of time throughout the year when flocks of migrating birds may be encountered by aircraft in flight. These charts indicate that the Toronto area is relatively clear as compared to other areas such as metropolitan Chicago which has the busiest airport in the world.

Studies have further shown that the area of the new Toronto airport is not particularly attractive for nesting or for resting and migration. Lakes Scugog and Simcoe are used by migrating waterfowl in autumn.

For short periods during autumn migration, flocks of waterfowl will pass southward over the airport site and its eastern and western approaches. Broad-winged hawks on autumn migration will pass through the area from east to west on one or two days in September. The days on which such flights occur can be forecast, as is presently done at Malton, thereby reducing the possibility of accidents. Thus, the situation at the new airport will be roughly equivalent to the situation at Malton.

There are some small birds resident in the area, which are most abundant in the heavy agriculture production areas, particularly corn fields. As flight operations at the new site will not commence before 1978/79, there is ample time to introduce necessary changes to the type of agricultural activity thereby further reducing any potential problem. The surrounding region contains ecological conditions similar to those on the site. Therefore, it can be expected that birds will seek safe new locations in the area.

In conclusion, the new Toronto airport site meets the safety considerations with respect to potential bird hazards and the effect on the few resident birds in the area will be minimal.

A P P E N D I X

SPRING MIGRATION

GEESE, SWANS, CRANES AND DUCKS

The accompanying charts depict the SPRING migration flyways and staging areas by which these birds generally proceed northward in Canadian Airspace. Indicated also are the approximate numbers of birds involved, the period during which the flyways may be used by the various species, and the altitudes at and below which flocks may be encountered.

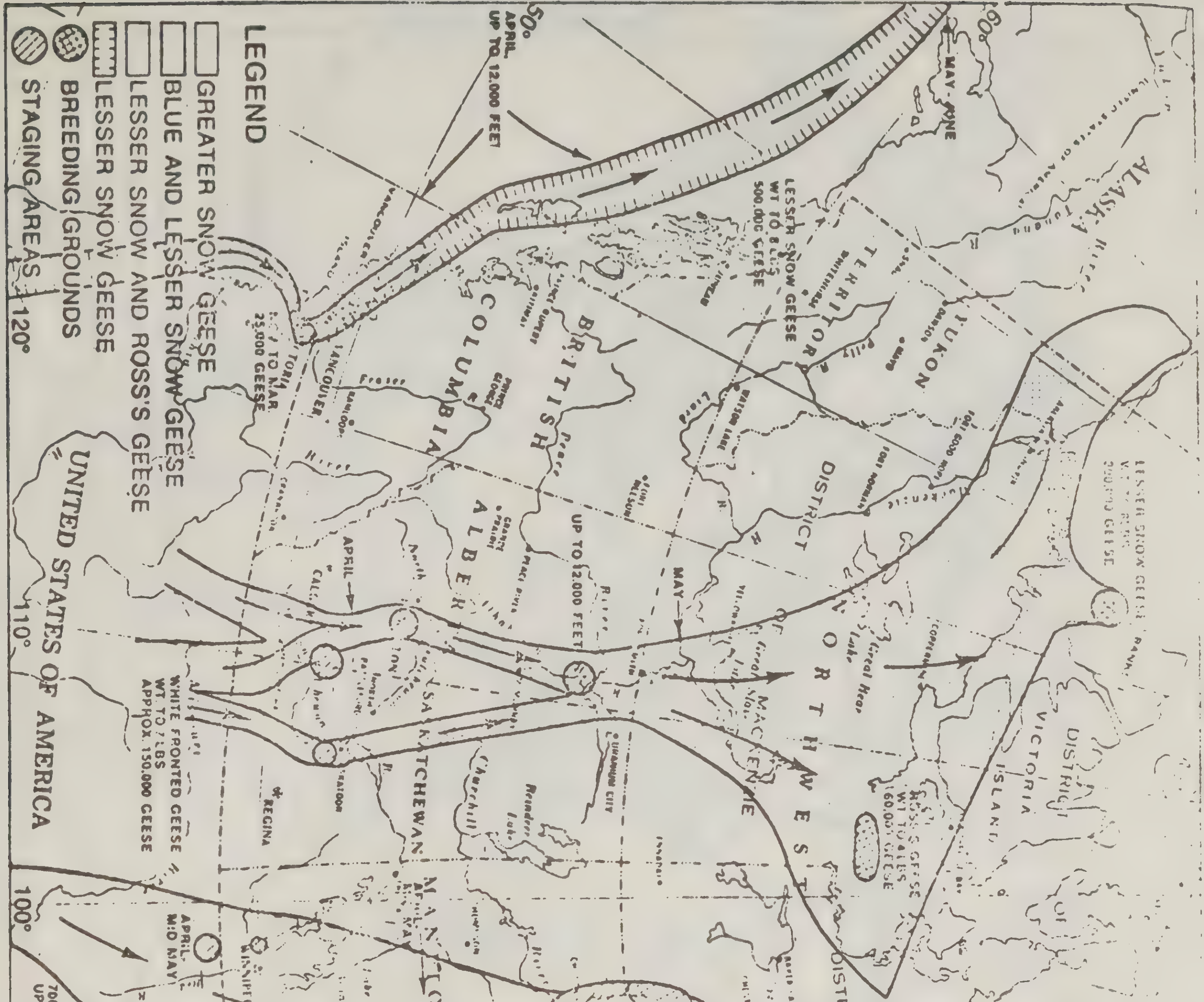
These large migrating birds are capable of flying above cloud and between layers at speeds of 30 - 45 knots. Flocks of 100 to 200 birds may be expected in flights strung out over several miles. Near the staging (resting and feeding) areas, they are generally encountered at or below 2000 feet above ground. Normally they leave the staging areas between dusk and midnight and during the first three hours after dawn, however, they may leave at any hour of the day or night, particularly after long periods of poor weather for migration. The longer the period of unfavourable weather the greater the likelihood that the birds will depart before really favourable weather moves over the area. Normally these birds will not leave a staging area against surface winds in excess of 10 knots. Major movements, involving hundreds of thousands of birds, often follow the passage of a ridge of high pressure.

The altitudes at which the birds may be encountered depend on the distance from the staging areas from which they have departed, assuming a rate of climb usually not more than 125 feet per minute or 100 feet per mile.

Ducks normally weigh from 1 to 4 pounds and the larger geese, swans and cranes may vary from 3½ to 25 pounds.

Pilots are urged to plan flights, in so far as it is possible, to avoid the airspaces in which flocks of migrating birds may be expected during the periods indicated.

SPRING MIGRATION ROUTES - GEESE



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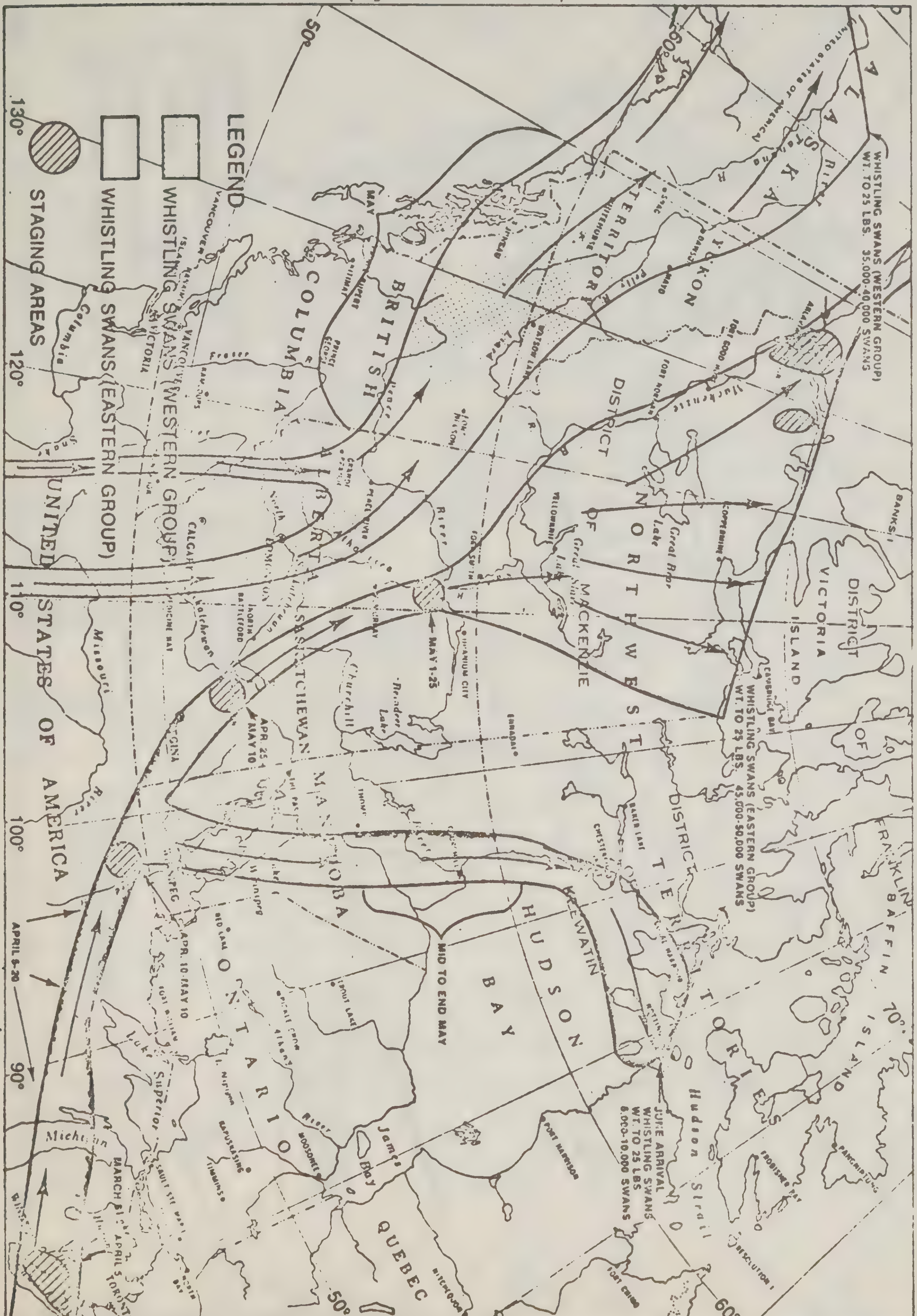
SPRING MIGRATION ROUTES - SWANS

(Flight Altitudes to 12,000 feet.)



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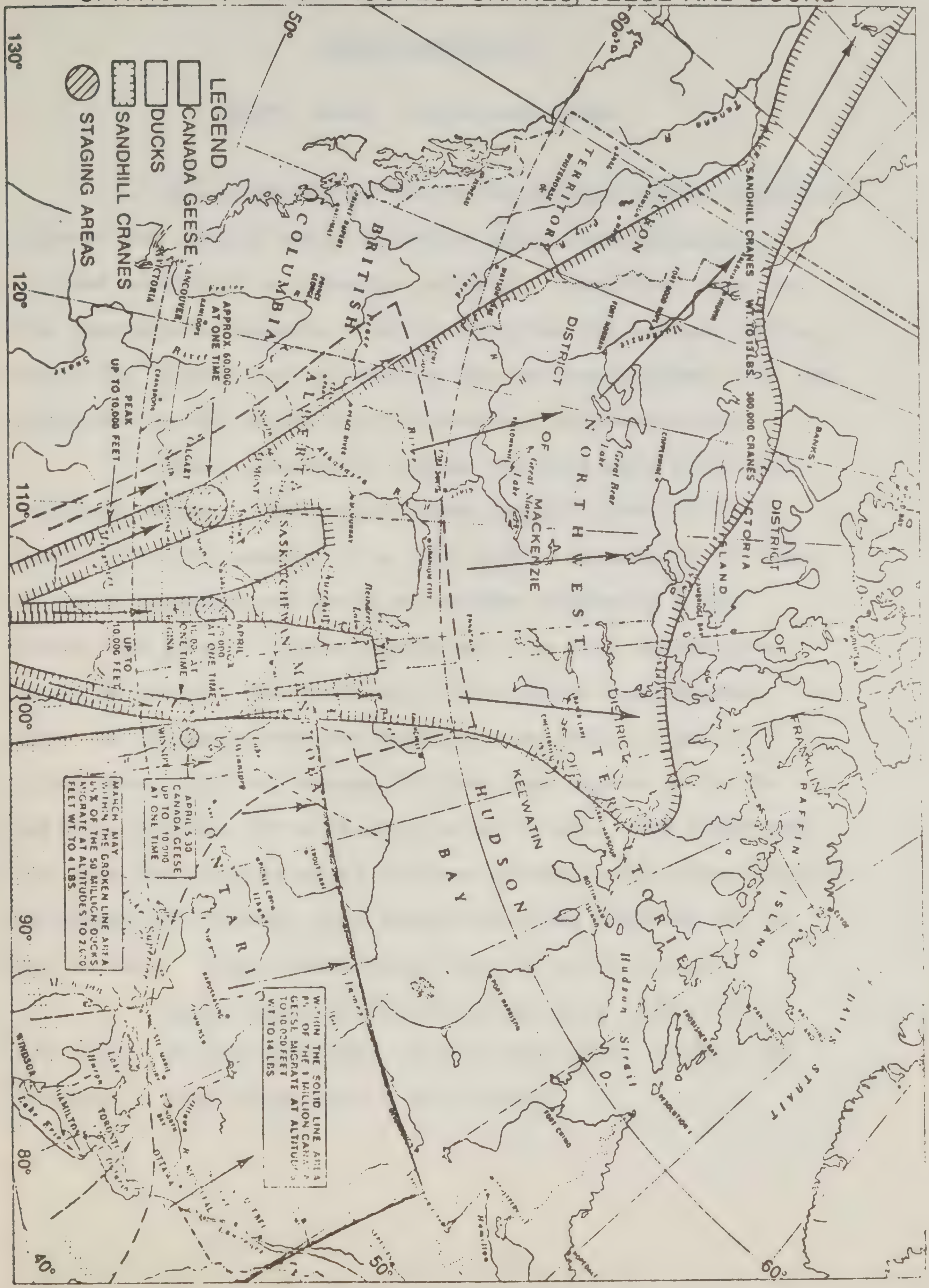
SPRING MIGRATION ROUTES - CRANES, GEESE AND DUCKS



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AUTUMN MIGRATION

GEESE, SWANS, CRANES AND DUCKS

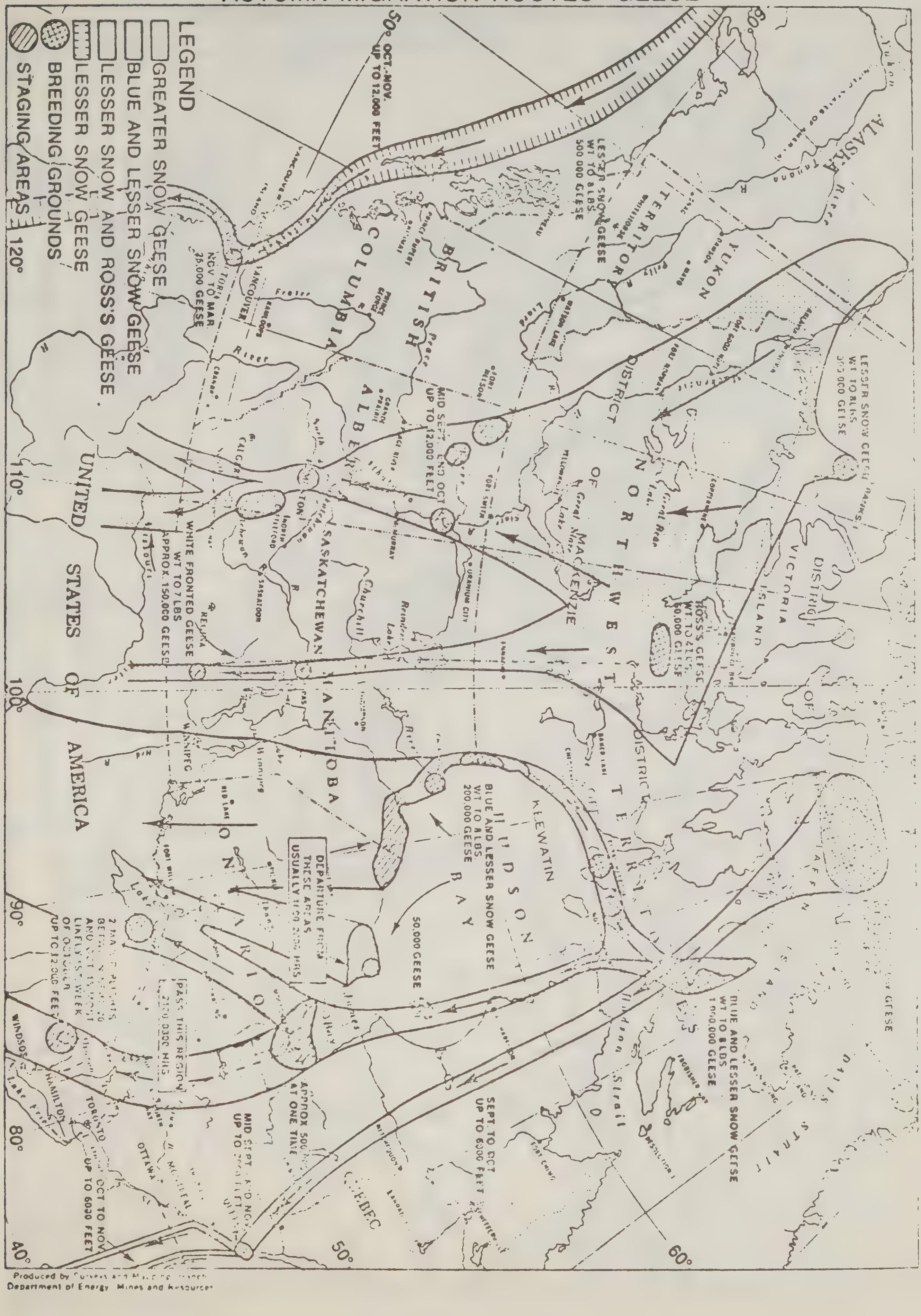
The accompanying charts depict the AUTUMN migration flyways and staging areas by which these birds generally proceed southward in Canadian airspace. Indicated also are the approximate numbers of birds involved, the periods during which the flyways may be used by the various species, and the altitudes at and below which flocks may be encountered.

Geese, swans and cranes normally move south with following winds. They depart from staging areas 12 to 24 hours after the passage of a cold front, especially if there is rapid clearing and there are strong northerly winds behind the front. Flight speeds will be wind speeds/plus 30 to 40 knots. The altitude of the flocks will depend upon the distance from the staging area using a rate of climb which will not exceed 125 feet per minute up to the optimum altitude for each particular flight. The birds take off from the staging areas in late afternoon for night flights. Occasionally however, with favouring winds they may fly by day as well. These birds weigh from 3½ to 25 pounds.

Ducks migrate over the whole area indicated on the chart, at low altitudes, during September, October and November. They weigh from 1 to 4 pounds.

Pilots are urged to plan flights, in so far as is possible, to avoid the airspaces in which flocks of migrating birds may be expected during the priods indicated.

AUTUMN MIGRATION ROUTES - GEESE



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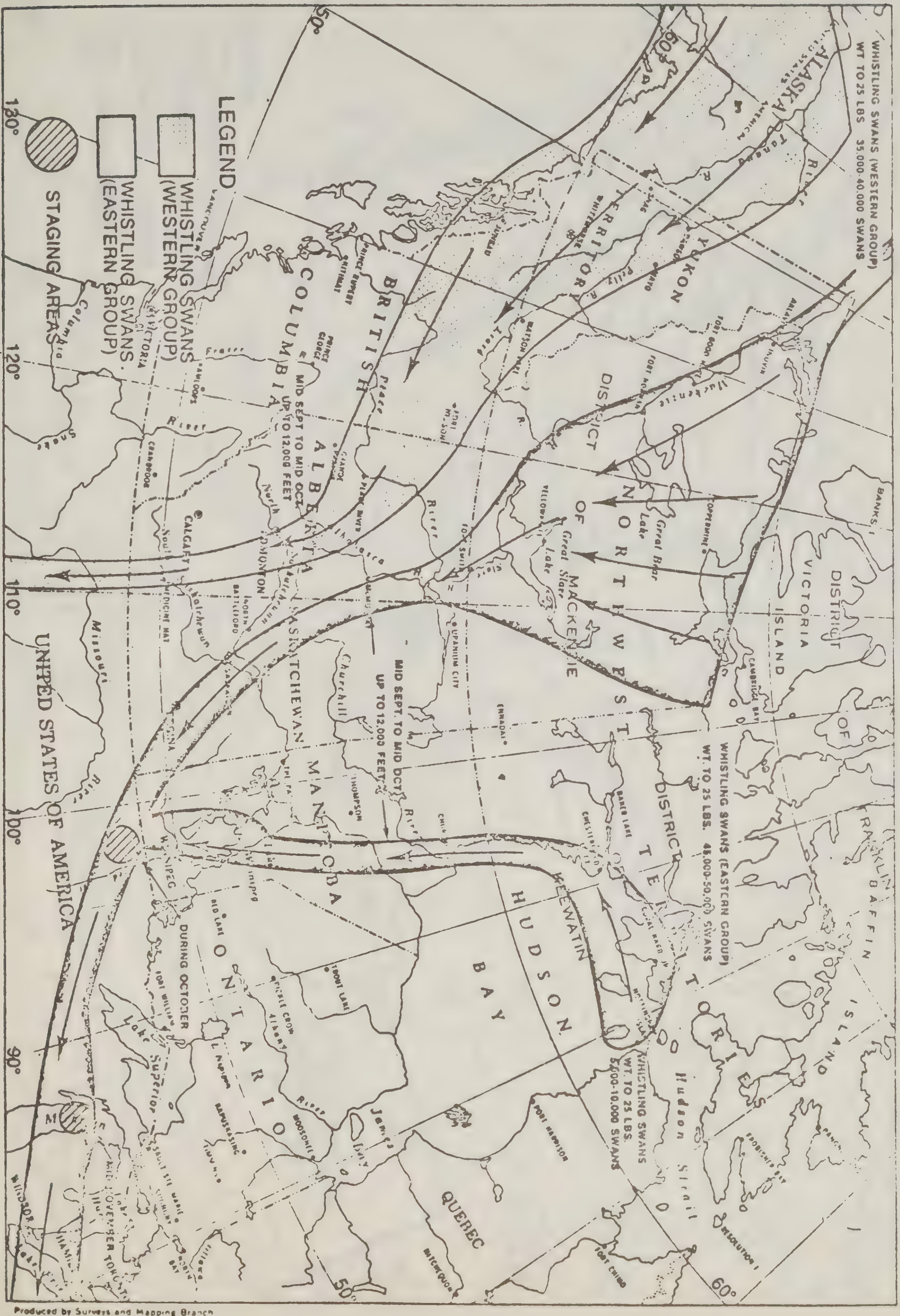
AUTUMN MIGRATION ROUTES - SWANS

(Flight Altitudes to 12,000 feet.)



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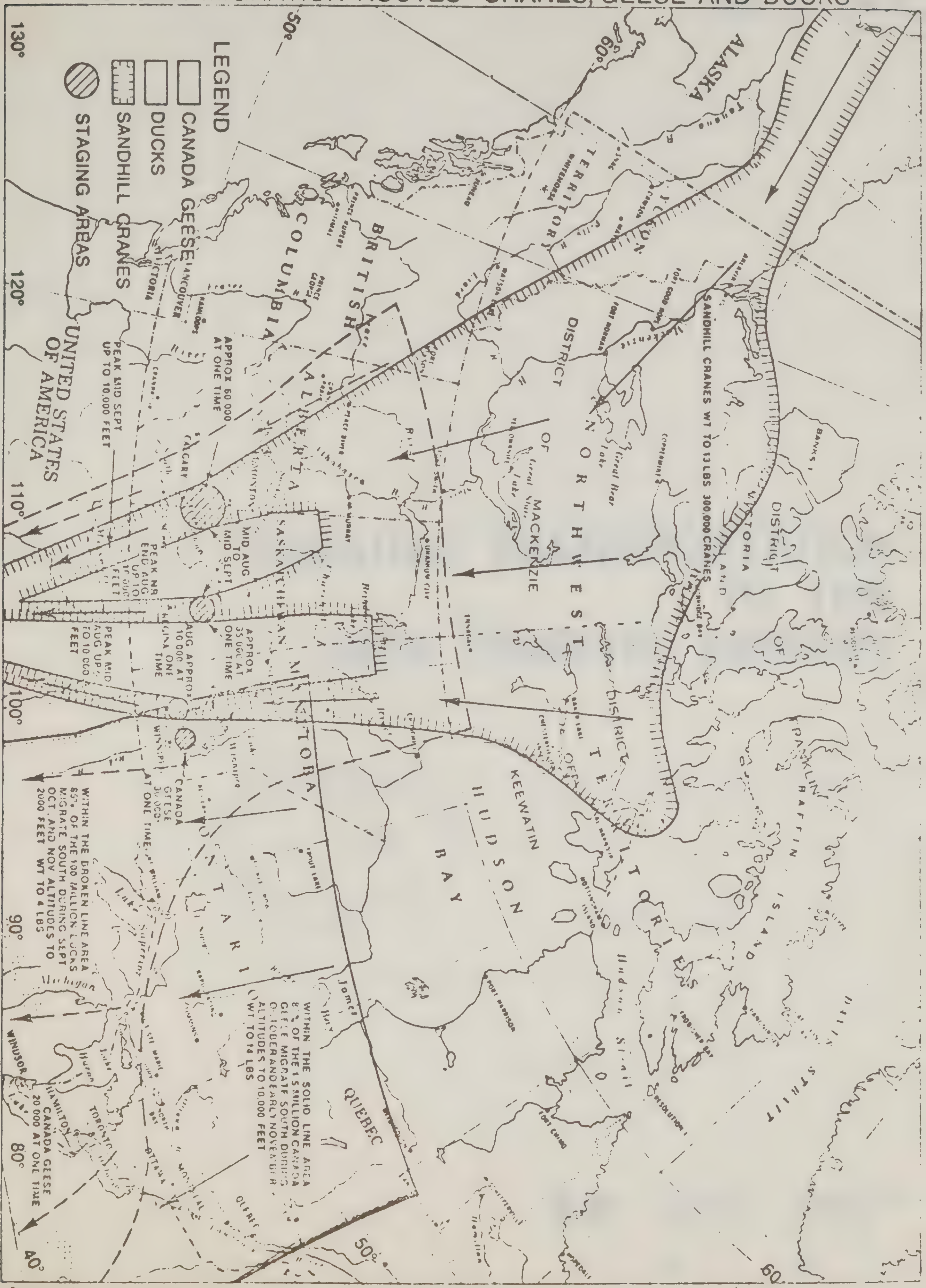
AUTUMN MIGRATION ROUTES - CRANES, GEESE AND DUCKS



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May 4 , 1972

GROUND TRANSPORTATION TO THE NEW TORONTO AIRPORT

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GROUND TRANSPORTATION ANALYSIS OF ALTERNATIVE AIRPORT SYSTEMS

1. INTRODUCTION

Convenient, comfortable and reliable access is important in the operation of a major airport. Therefore, in developing an aviation plan for southern Ontario and in planning for the new Toronto airport, the Ministry of Transport made detailed studies on the provision of ground transportation facilities with Provincial participation.

This report summarizes the historical background of expansion of ground transportation serving existing airports. The methodology used in the detailed studies is explained and the findings of the studies are outlined. The general conclusions, based upon the findings, that will guide the on-going planning for the new airport are discussed in some detail.

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2. HISTORICAL DEVELOPMENT OF GROUND TRANSPORTATION

When Toronto's International Airport (Malton) was opened in 1938 the largest passenger aircraft making use of the airport could accommodate only 14 passengers. There were fewer than ten scheduled aircraft movements per day. The area surrounding the airport was predominantly rural. During this period of Malton's operations, traffic to and from the airport was readily accommodated on the local minor road system.

By the early fifties, the fast growing demand for air travel facilities in Toronto led to increasing demands for improved ground transportation. This trend continued through the early sixties, with the expansion of the Toronto market and with the introduction of jet aircraft.

The Airport Expressway was opened in 1964 to accommodate this traffic. It provided freeway access to the airport site with excellent connections into the extensive regional freeway system. To cope with airport traffic growth additional access routes have been planned in the form of direct freeway links to the proposed Highway 409 (Belfield Expressway) and Highway 427.

Public transit services for air passengers travelling to or from the airport were not used extensively in the early 1960's. Access by automobile on the freeways was convenient and comfortable while the existing transit services were indirect and less convenient. In response to growing demand consideration

was given to improving public transit access. In 1969 the TTC introduced an express bus service from the Islington station on the Bloor subway non-stop to Malton Airport. The service has been very successful and can be seen as the forerunner of further improvement in transit service.

In leading world communities, it has become apparent that the unique advantages of rapid transit will become increasingly important in the development of urban transportation. Roads alone cannot cope with the concentrations of travel demands. Rapid transit provides more passenger-carrying capacity on less urban land, will contribute significantly less to pollution, and promises reliable, convenient service.

Regional rapid transit systems must be developed and combined with the complementary regional road system to continue to assure adequate ground access to airports in the Toronto-Centred Region. In some circumstances, these facilities will be able to serve other regional travel needs.

3. INITIAL TRANSPORTATION STUDIES

As part of the development of the aviation plan for southern Ontario, the Ministry of Transport studied ground transportation access to sites being considered for the new Toronto Airport. In the initial stage, many possible sites were

identified. Four sites, each representative of a general zone were selected for further study, namely, those labelled as N, E, W and NW on Exhibit 1.

The Ministry of Transport commissioned De Leuw Cather and Company of Canada Limited to make the study. This study was completed in early 1970 and documented in a report entitled "Transportation Study, Alternative Site Location."

The study consisted of four components:

<u>Passenger Demand</u>

A detailed ground transportation survey was carried out in the summer of 1969, to obtain basic data on travel patterns to and from Malton Airport. From this information, relationships were derived for estimating trips by air passengers and cargo vehicles to and from various locations in the Toronto region. The social and economic characteristics of the Toronto region and forecasts of total air passengers were incorporated in the development of these relationships.

Utilizing these statistical relationships and forecasts of the distribution of future population in the Toronto region in the target year 1990, estimates were made of the volume of travel to and from each of the four sites for each type of traveller (air passenger, sightseer, well-wisher, airport business, etc.) and by each class of vehicle (private auto, taxi, bus, truck).

AIRPORT SITES

TORONTO AREA AIRPORTS PROJECT

EXHIBIT I

Facilities

In the next stage of the study these travel demands were compared with the existing and future transportation facilities which were planned by Provincial and Municipal agencies. An analysis of the supply/demand relationship with respect to both public transportation facilities and roads was completed. Additions to the plans were proposed and a supplementary program outlined. The capital and maintenance costs for construction and operation of the additions were then estimated.

Passenger Convenience

Total costs to the users of the airport for the operation of vehicles were estimated on the basis of the travel demand and target year (1990) and were used in conjunction with appropriate cost rates per mile. The convenience for the air passenger were measured in terms of time spent in travel to and from these four sites.

Study Conclusions

All of the previous information was evaluated together with other important factors, and the conclusions drawn from the advantages and disadvantages of each of the four sites. The report demonstrated that the West site was more convenient than the other three. It was later recognized that the convenience of the W was due to its location between the two major regions of passenger demand in southern Ontario: the Toronto area and south-western Ontario.

Ground transportation was one of a number of aspects studied with regard to the four sites. Drawbacks were identified in relation to these other aspects. The W site which was relatively convenient would conflict with the airspace required to meet safety standards around Malton Airport.

The study on sites for the new airport was part of the broader on-going investigations on the aviation plan for Southwestern Ontario. Consequently, no decision could be taken in 1970 in view of the drawbacks identified at each of the four sites and the additional information being produced by the continuing work on the aviation plan.

The Province of Ontario was establishing a firmer definition of the plan for the development of the Toronto-Centred Region. This information affected points of origin of future air passengers throughout the region and therefore had important implications for the ground transportation studies in the spring.

4. GROUND TRANSPORTATION STUDIES FOR THE AVIATION PLAN

In the spring of 1971, a more thorough analysis of the distribution of air passengers in the Toronto region was carried out. This review included the categorization of air passengers by short haul and long haul market segments, and analysis of their present and future distribution throughout the region.

These studies reassessed the relative convenience of various airport sites and in particular the relative convenience of various systems of airports to serve southern Ontario. Several additional sites were examined. This work demonstrated that, as southern Ontario really consists of two broad areas of air passenger demand, the Toronto area and Southwestern Ontario, it would be more convenient to have two systems of airports, one for each area specifically developed to meet the traffic needs of the area, rather than one new airport. The aviation plan comprising the selected site for the new Toronto airport and Malton serving the Toronto area and a system of airports for Southwestern Ontario was shown to be much more convenient than the W site with Malton.

In this work of 1971, it was possible to incorporate the estimating analysis techniques from the previous study and to apply them in a more general way to airport systems. This approach was the basis of the more rigorous examination of the basic variables in passenger distribution in the Toronto region which has important implications on ground transportation planning.

For example, in the first study a forecast of socio-economic data for the various parts of the Toronto region in the future was readily available only on a "Trends" basis,

and did not account for the Province's Toronto-Centred Region plan for recasting future development. As a result, certain assumptions had to be made on population distributions in the first round of studies which were superceded by subsequent Provincial planning work.

In the time span between the first and second series of studies, Provincial planning agencies had developed better forecasts of the socio-economic variables and their distribution throughout the Toronto-Centred Region. The Ministry of Transport conducted an extensive survey in the summer of 1971. The results of this survey permitted more accurate calculations on the propensity of people in different parts of the region to make air trips. This information was incorporated in the subsequent transportation studies on the aviation plan. Finally detailed comparisons were made on three of the original four sites (Site N had been dropped for sociological and environmental reasons) and on the selected Northeast site as well as a site to the Southwest.

The number of miles travelled by air passengers is the basis of estimating demand for various types of ground transportation facilities, for establishing the costs to the air passenger and the convenience of the service.

From the previous study of the original four sites a relationship was established between direct costs to air passengers (all classes of traffic combined) and the number of miles. Another relationship was established between the number of miles travelled and the extent and cost of regional road and rapid transit facilities.

The distribution of the origins and destinations of air passengers throughout the Toronto region was estimated for three particular years in the future within the planning time frame, namely 1977, 1990 and 2000. For these three years forecast of population in each part of the Toronto region were obtained for two conditions: "Trends," referring basically to a continuation of the existing growth characteristics of the region, and "Design for Development," reflecting the influence on future population distribution of the Provincial Toronto-Centred Region Plan.

The number of air trips per 1,000 population within each part of the region in 1990 and 2000 were assumed to vary between the number determined in the 1969 and 1971 surveys at Malton (referred to as "Existing" trip rate), through to a situation where the number of trips per 1,000 population would be almost uniform (referred to as "Uniform" trip rate). Distributions were thus made of the total forecast air passengers for each year, to the various parts of the region.

Calculations were thus made of the total number of miles that would have to be travelled by air passengers to the various airport sites in the system. Direct user costs and capital costs for ground transportation facilities were then calculated using the passenger mile figures and the appropriate relationships described above, to yield costs for each of the years 1977, 1990 and 2000. Passenger convenience in terms of number of hours of travel was also calculated.

Totals were then derived for the period 1971 to 2000 of the direct user costs and passenger convenience. Capital and operating costs for rapid transit and access roads were totalled over the same period. These studies thus included all expenditures on ground transportation for the various airport systems, including the sites within Malton.

In these studies on the aviation plan, the requirements for transportation facilities were examined to the year 2000. It was demonstrated that much greater use would be made of rapid transit facilities in the latter part of the period. It was further evident that the early introduction of such facilities would be desirable in view of their advantages in this service.

In the following paragraphs the results of these studies and the incorporation of these results in the aviation plan are described. This announced aviation plan consists of an airport system for South-western Ontario and an airport system for Toronto: a new Toronto airport and Malton. In these studies, five sites for this new airport were examined in combination with Malton; W, NW, and E plus two additional sites SW and NE. It was assumed that Malton would continue to handle a proportion of future air passenger and cargo traffic approximately equal to the volume in the late 1970's, and the new airport would accommodate increases in air passenger and cargo traffic after that time.

5.1 Distances between Sites and Selected Communities

The proximity of the airport sites to the various parts of the Toronto region is illustrated in Table 1 attached. This table shows the approximate distance from each of eleven areas in the region to Malton and to the five sites for the new airport.

It will be noted from the table that some sites are relatively far from the large population concentrations. For instance, the SW, NW and E sites are 54, 53 and 49 miles from central Toronto respectively, whereas M, NE and W are much closer.

The remoteness of the SW, NW and E sites becomes even more apparent when the distances from points on the other sides of Metropolitan Toronto are considered, i.e. the E site is about 93 miles from Hamilton and 86 miles from Guelph, the SW site is 85 miles from Barrie and 82 miles from Oshawa, and the NW site is 58 miles from Hamilton and 77 miles from Oshawa. Therefore such sites would not only be less convenient to Toronto but would severely inconvenience travellers from opposite points of the region. An important measure of the convenience of a site is the maximum distance that a significant proportion of users would have to travel to reach it. On this particular basis the more centrally located sites such as the NE and W would be favoured for a new airport.

5.2 Ground Travel Flows To/From Airports

The magnitude of traffic volumes travelling to each airport and the various origins or destinations within the Toronto region determine the routes that are required, the user costs and the total time spent.

Estimates were made of all of this traffic using nine classes of vehicles shown in Table 2 attached. These include 6 classes of vehicles that operate on roads, 2 types of transit vehicles and a final category for inter-airport traffic. It is proposed that the airports be served by both a rapid transit service operating on exclusive right-of-ways that will be grade-separated from all other forms of traffic, and by the regional road system.

Table 2

COST RATES PER VEHICLE MILE OF TRAVEL

Classes of Vehicles	Vehicle Operation (per veh. mi.)	Commercial Vehicle Driver's Time (per veh. hr.)
1. Private autos carrying passengers	6¢	-
2. Private autos carrying cargo	6¢	$5
3. Taxis	6¢	$5
4. Limousines	6¢	$5
5. Buses operating on the common road system with other traffic	20¢	$5
6. Trucks operating on the common road system with other traffic	10¢	$6
7. Rapid transit passenger vehicles	20¢	$5
8. Rapid transit cargo vehicles	10¢	$5
9. Inter-airport traffic (all types of vehicles)	10¢	$6

5.3 Direct Costs to Airport Users

The number of miles travelled by air passengers in these vehicles was then calculated for the period 1971 to 2000. The total direct costs to these passengers were calculated according to the established methodology.

Table 2 shows the cost rates per vehicle mile of travel employed for this purpose. The rates for vehicle operation include a value to cover the cost of fuel, tires, engine oil, and maintenance, plus an allowance for depreciation due to wear-and-tear and for insurance. The rates for the operator's time in commercial vehicles include allowances for direct salary and fringe benefits plus management and administrative overhead.

Using a relationship established between passenger miles of travel and average direct cost to users for operating vehicles, each of the airport systems was evaluated. Total direct user costs resulting from these calculations are shown in Table 3 attached. The results demonstrate that direct user costs are a significant factor. The NW and E sites are shown to be significantly less convenient than the NE, W and SW. Cumulative total costs in present value for these sites,in combination with Malton,range from 900 million to one billion as compared to 700 million to 750 million for the NE, W, and SW combined with Malton.

Table 3

COMPARISON OF DIRECT USER COSTS, 1971 - 2000
($ million)

Order of Least Cost	Total Cost	Additional Cost over W + M	Additional Cost over NE + M	Additional Cost Over SW + M	Additional Cost over NW + M
W + M	2,900	-	-	-	-
NE + M	3,240	340	-	-	-
SW + M	3,300	400	60	-	-
NW + M	3,760	860	520	460	-
E + M	4,230	1,330	990	930	470

Note: All costs are cumulative and are given in 1969 dollars constant

Discounted at 8% to 1971

Order of Least Cost	Total Cost	Additional Cost over W + M	Additional Cost over NE + M	Additional Cost Over SW + M	Additional Cost over NW + M
W + M	690	-	-	-	-
NE + M	760	70	-	-	-
SW + M	760	70	0	-	-
NW + M	880	190	120	120	-
E + M	990	300	230	230	110

[illegible]

The estimates are important to indicate the relative distances between sites. They do not represent new expenditures caused by the development of a new airport, as expenditures of this nature would be incurred by air passengers travelling to Malton if all air travellers were forced to continue to use Malton.

The W site appears preferable because of its location between the Southwest area of air passenger demand and the Toronto area. With the improvements to air service in Southwestern Ontario, this apparent advantage of the W site is largely offset. The NE site, being closer to centre of the Toronto area, was proven to be most convenient for the new Toronto airport, in conjunction with Malton and a system of airports in the Southwest.

5.4 Hours of Travel for Airport Users

The convenience of the alternative airport sites can also be expressed in terms of hours of travel. Using methods similar to those described above for calculating vehicle miles of travel, the number of enroute hours which would be taken by air passengers for travelling to and from the airports on the regional transportation systems were derived. The results are shown in Table 4 attached.

Table 4

COMPARISON OF HOURS OF TRAVEL TO/FROM AIRPORTS
BY AIR PASSENGERS, 1971-2000
(million)

rder of east ime	Total Hours	Additional Hours Over W + M	Additional Hours Over NE + M	Additional Hours Over SW + M	Additional Hours Over NW + M
+ M	430	-	-	-	-
E + M	470	40	-	-	-
W + M	480	50	10	-	-
W + M	540	110	70	60	-
+ M	580	150	110	100	40

ote: All passenger hours of travel on the regional ground transportation system are estimated using relatively uncongested conditions on the highway system, and average operating speeds on the rapid transit system similar to that for highways.
Passenger hours are cumulative 1971 to 2000.

These results reinforce the conclusions drawn from the direct user costs. It is useful to calculate the time, as differences in convenience in the order of hundreds of millions of hours are significant regardless of the value that may be placed upon the passenger's time.

Table 4 illustrates the substantial degree of inconvenience which would occur for travellers if either of the NW or E sites were chosen for a second Toronto airport. Again the apparent advantages of the W site over the NE are offset with the development of the airport system for SouthWestern Ontario accommodating that market. The improvements to the existing airports in the southwest in turn offset, in the short term, the advantage of the SW site.

5.5. Types of Ground Transportation Systems

Access from the various parts of the Toronto region to the the alternative new airport sites, to Malton airport, and between the two airports, has been considered in developing plans for ground transportation facilities to accommodate travellers. Rapid transit access has been found to be necessary in the long term, and regional highway routes existing and planned by the Province and the municipalities will give additional service. Also, it was recognized at the outset that plans for airport access systems would have to be integrated with the overall

general regional transportation system, and must be in concert with the plans of the Province of Ontario and the municipalities in the region.

Several types of rapid transit concepts were considered for serving airport oriented travellers, including both conventional and advanced technology systems which have been tested for application in commercial transit service.

It was neither necessary nor possible to make a final decision on the type of rapid transit system which should be developed. This decision is the subject of on-going planning work with Provincial authorities. However, the general type of system required was specified so that a representative system could be selected for study purposes and to provide necessary information for the decisions on the aviation plan.

The general conditions are the complete separation of rapid transit vehicles from other forms of traffic, reliability and safety. The special conditions that the system must satisfy for air passengers are:

(i) A standard of service in terms of travel times which would be comparable to or better than than allowed by use of private vehicles.

(ii) An operating cost (fare) no higher, and preferably less costly, than would be the case for use of private vehicles.

(iii) A level of comfort comparable to that given by inter-city transportation services, in terms of seat availability, interior environmental control, and riding qualities of the vehicle.

(iv) A capability for integration with the general regional rapid transit services. It would be necessary to connect to and complement the rapid transit systems which exist, are under construction, or are planned by regional authorities for serving general regional travel needs, especially those in Metropolitan Toronto. However, the airport-bound rapid transit vehicles must be able to by-pass local service rapid transit vehicles and stations in order to provide for a non-stop point-to-point trip.

(v) A capability to allow for incremental expansion as needs are demonstrated in the future. The rapid transit would be expected to connect a series of off-site passenger and cargo processing centres scattered throughout the entire Toronto region served by the airport, by means of routes constructed on feasible and available rights-of-way.

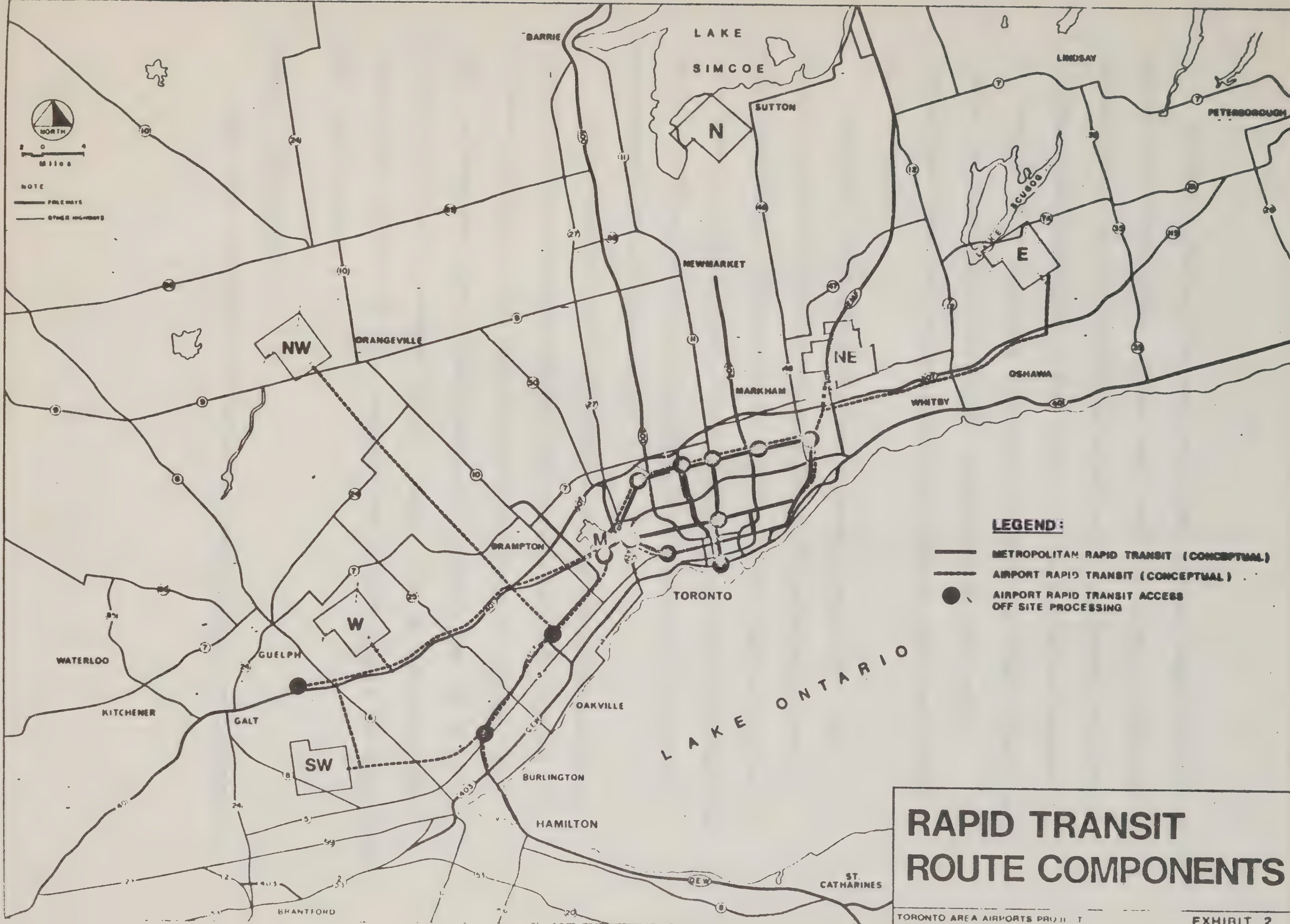
(vi) The airport rapid transit system must have relatively low capital construction cost, consistent with the "intermediate" capacity systems.

The representative system selected for the purpose of the study consists of a network of grade-separated, exclusive travelled ways constructed in the median of proposed regional freeways and in utility corridors. These would connect the airports to a series of off-site passenger and cargo processing centres, the existing and proposed rapid transit systems in Metropolitan Toronto, and link the airports to each other. Connections could be made with the airports and downtown Toronto via the municipal rapid transit system, supplemented by surface transit connections on the regional road system. This could be extended to such commuter systems as the GO-Transit where they are in proximity to the site.

For costing purposes a passenger vehicle, like the most modern air-conditioned inter-city buses was assumed for the short term. This vehicle would include special features, such as equipment for easier and quicker baggage handling. A cargo vehicle similar to conventional trucks but also having special provisions for loading and unloading was assumed for the short term. These vehicles would provide a high standard of service; yet maintain the maximum flexibility to accommodate technological developments in the future, both in regard to the regional transportation system and that within the airport property. Inconvenient transfer of passengers' baggage and cargo between modes would be minimized.

The important advantage of this approach is the ability to adapt the routes and rights-of-way to accommodate vehicles utilizing rail, air cushion, or other means of suspension and guidance, when and if they become feasible for practical implementation and exhibit superior qualities over more conventional systems. Exhibit 2 shows a possible long range network of such rapid transit routes throughout the Toronto region.

Reliable estimates of cost and performance could be prepared using such known vehicles and transit routes.



RAPID TRANSIT ROUTE COMPONENTS

TORONTO AREA AIRPORTS PROJECT

EXHIBIT 2

Improvements to the regional road system would also benefit passenger convenience. These can take the form of additional lanes which could be added to existing or proposed Provincial freeways and highways in the area, and in a limited number of instances, by entirely new road connections where existing routes or previously developed road plans do not exist. Connections between the regional road system and the airport will be made.

Exhibit 3 shows the highway system planned for the Toronto region in the future according to provincial and municipal plans, together with the new links that would be convenient to the airport sites studied. It will be noted that the E and NE sites require minimal construction of entirely new freeway route connections.

The estimated capital construction and maintenance cost for the road and rapid transit additions required to 2000 is show in Table 5 for each alternative airport system. It will be observed that these costs are in the order of $150 to $200 million in present value. Again, it is apparent that the NW and E sites are at a significant disadvantage in comparison with other sites.

6. GENERAL CONCLUSIONS

From this analysis the following conclusions can be drawn:

REGIONAL ROAD NETWORK 1990

TORONTO AREA AIRPORTS PROJECT

EXHIBIT 3

Table 5

COMPARISON OF DIRECT USER COSTS, 1971-2000
($ million)

Order of Least Cost	Total Cost	Additional Cost over W + M	Additional Cost over NE + M	Additional Cost over SW + M	Additional Cost over NW + M
W + M	380	-	-	-	-
NE + M	410	30	-	-	-
SW + M	430	50	20	-	-
NW + M	480	100	70	50	-
E + M	480	100	70	50	0

Note: All costs are cumulative and are given in 1969 dollars constant

Discounted at 8% to 1971

Order of Least Cost	Total Cost	Additional Cost over W + M	Additional Cost over NE + M	Additional Cost over SW + M	Additional Cost over E + M
W + M	160	-	-	-	-
NE + M	170	10	-	-	-
SW + M	190	30	20	-	-
E + M	200	40	30	10	-
NW + M	210	50	40	20	10

1. Adequate ground transportation connections can be made to serve travel to and from each of the alternative airport systems.
2. The introduction of rapid transit to serve airports in the future is a necessity. The most suitable system should be able to connect airports to each other, to the municipal rapid transit systems, and to a series of off-site processing terminals strategically located throughout the region at key interchange points with other ground transportation modes. Additions and improvements to the road network in proximity to each site will also be required.
3. On the basis of total capital and user costs, and passenger convenience expressed in hours of travel, the W, NE and SW sites are far superior to either of the NW or E sites.
4. The W site appears more favourable because of its location between the two areas of large passenger demand. The NE site is the most convenient and least costly to serve the Toronto area with Malton. This Toronto airport system, in combination with a system to serve the specific needs of Southwestern Ontario is the best system to serve the total requirements of southern Ontario.

In addition to passenger convenience, the NE site was the only site that did not suffer any major drawback. The W site would not satisfy the airspace safety requirements and also conflicted with the objectives of the Ontario regional development plan. The SW site is very close to the Beverly Swamp and could have resulted in significant environmental disruption to a unique feature in the regional landscape. In any case, improvements to the regional airports in southwestern Ontario offset some of the advantages of the SW site in the short term.

7. THE NORTHEAST SITE

Roads leading to the NE site serve recreation traffic from Metro Toronto to areas north and east of the airport. It can be expected that during periods of peak recreational traffic much of the available highway capacity will be utilized. Rapid transit facilities will, therefore, be more extensive and the advantages of this service will be available earlier at this site.

The Federal and Provincial Governments recognize the increasing importance of rapid transit for urban and regional transportation as well as airport access. Provincial authorities are intensively examining feasible rapid transit systems to serve the people of the Toronto-Centred Region and the approach for the new Toronto Airport is consistent with this policy.

It appears that the existing regional road system and those improvements proposed by the Province and Municipalities should, with incremental further additions, handle the private vehicular traffic destined to the new Toronto airport.

The Federal and Provincial Governments together with the Municipalities are continuing to study the development of ground transportation facilities to assure both roads and transit will be properly integrated into the regional transportation network.

Toronto Area Airports System

May 4 , 1972

LAND USE AND THE NEW TORONTO AIRPORT

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ENQUIRIES

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LAND USE

The Ministry of Transport has been intensively studying the need for and the development of airport facilities for the Toronto region since 1966. The first phase from 1966 to 1967 examined the manner in which Toronto International Airport (Malton) might be expanded to accommodate the fast growing traffic volumes, and particularly the long-haul passenger demand.

In 1968 the plan for the expansion of Malton was rejected in view of the large scale disruption that continued airport expansion would cause to established residential communities. This decision had widespread public support.

In 1969 studies continued on the Aviation Plan for Southern Ontario, including the possibility of a new Toronto airport. A considerable number of sites were identified in four broad zones, to the North, East, West and Northwest. One site, considered to be representative, was selected from each zone for the purpose of preliminary evaluation.

The four sites selected were examined against a number of criteria such as airspace management, weather, and passenger convenience. Among the most important criteria are number of people affected at each possible location, existing and potential land uses, and possible patterns of development consistent with airport construction and operations. A preliminary study of these factors extending over a period of two and a half months was completed

in February 1970. This study which was commissioned by the Ministry of Transport from Project Planning Associates Ltd. is briefly described in this paper.

The work of some of the preliminary studies including the P.P.A. Ltd. report was summarized in an interim report, produced in September 1970. During this period work was continuing on the Aviation Plan for Southern Ontario, and by early 1971 it had been established that two systems of airports - a Toronto Area system, and a system for Southwestern Ontario - would meet the air travel needs of the two regions better than a single new airport. In such a plan, it was determined, the New Toronto Airport would require a maximum of four runways only. This not only meant that other possible sites could be considered for the new airport, but also considerably reduced the area which might be affected by noise. The Northeast site, north of Pickering, and the Southwest site, at Peters Corners, were identified for inclusion in the final evaluation.

BACKGROUND

In November 1969 planning studies of the four representative sites were commissioned, to evaluate and recommend patterns of desirable land uses for the 82,810-acres of lands which might be affected by flight operations at each. These studies were to:

1) provide a pattern of economically and socially required

land uses which would be compatible with airport operations;

2) identify opportunities for financial return to partially defray capital investment costs in the airport;
3) protect the unknowing land consumer;
4) assure that the airport impact area would develop properly through co-ordinated government planning;
5) minimize the negative aspects of non-use of important lands;
6) indicate the feasibility of proposed land uses from a servicing aspect.

The consultants undertaking the study were also instructed to work closely with the Goals Planning Committee of the Province of Ontario in matters related to that Committee's forthcoming policy recommendations.

At this time it was assumed that the Government of Canada would, in addition to the site required for airport operations, acquire all of the land that might be affected by future flight operations. The study was designed to demonstrate how these lands might be managed by the Federal Government after acquisition, paying special attention to ensuring that only uses compatible with future flight operations would be permitted.

The report of this study was submitted before the Goals Planning Committee of the Province of Ontario had completed the first phase of its work. It noted however that the consultant's understanding of the Provincial policies at that time placed severe limitations on the study in terms of the land use potentials of the areas affected by flight operations. To quote: "The target populations

referred to (i.e. those defined by the Province) set limits on the future growth of centres in close proximity or adjacent to the Noise Lands such as Guelph, Orangeville, Acton, Georgetown etc. As a result very little opportunity is provided for the rationalization of urban growth patterns to utilize portions of the Noise lands. The industrial land use potential of the Noise lands has been reduced considerably because of this. In addition, the possibilities for including urban related uses (other than residential) within the Noise lands is virtually non-existent."

The publication of "Design for Development: The Toronto-Centred Region" by the Government of Ontario in May 1970 set a more definite framework for planning the airport in the context of Urban-Regional Development Goals. Over the same period of time discussions with Ontario had established that the Province was both able and willing to ensure that only compatible development would be permitted in the lands which might be affected by flight operations. This obviated the need for the Federal Government to purchase such lands to ensure land-use compatibility, and emphasized the need to integrate airport planning with the broad planning of the Toronto-Centred Region. The "Status Report on the Toronto-Centred Region" published by the Government of Ontario in August 1971 provided a further definitive basis for evaluation.

In the context of the Aviation Plan for Southern Ontario six sites were selected for final evaluation. These were:

- the West site - between Guelph and Milton
- the Northwest site - near Orangeville

- the North site - just south of Lake Simcoe
- the East site - just south of Lake Scugog
- the Northeast site - north of Pickering
- the Southwest site - at Peters Corners

The first four of these sites were the subject of the P.P.A. Ltd. report. The material in that report, and new information developed for the two additional sites, was reappraised in the context of the subsequent agreements reached with Ontario, the more definitive planning which had been undertaken by the Province, and the updated airport requirements.

EVALUATION CRITERIA USED IN THE REAPPRAISAL

1. Political Boundaries

A review of local government boundaries form part of the Provincial regional planning process. As a consequence, Ontario considered that such a review would be necessary wherever the new Toronto airport were to be located. Because of this, the relationship of possible sites to existing municipal boundaries not a significant item in the evaluation.

2. Existing Land Use and Population

Existing land use is the use to which the land in the vicinity of the airport, and most especially the land which might in future be affected by flight operations, is currently being put. This includes not only active uses such as farming or industry, but also more passive uses such as woodland and conservation. The trends in current land use were also taken

into account, i.e. is the land use tending to remain static, or is it changing and, if so, what are the implications of such changes?

The number of persons likely to be affected by acquisition was estimated by reference to published data and recent air photography. Similarly, the number of persons who might in the future be affected by flight operations was estimated, on the basis of representative runway layouts.

3. Planning and Development Activity

Under this heading the P.P.A. Ltd. report, examined subdivision activity on and near each site. This is one of the indicators of imminent urban expansion, which subject was dealt with in the reappraisal under several other headings. Planning policy issues are of considerably greater significance, and these are covered under "Urban/Regional Planning".

4. Agricultural Capability

Capability for agricultural production was estimated on the basis of mapping undertaken by the Government of Ontario on behalf of the Federal Government under the Agricultural and Rural Development Act. This map series, entitled "Soil Capability for Agriculture", places all non-organic soils in seven classes ranging from Class 1 (which has no significant limitations in use for crops) to Class 7 (which has no capability for arable agriculture or permanent pasture). Classes 2 to 7 inclusive, are divided into sub-classes which reflect the

nature of the soil limitation in specific cases. The full descriptive legend is reproduced as Figure 1.

In addition to the maps at a scale of four miles to one inch used in the P.P.A. Ltd. study, use was made in the reappraisal of the more detailed Provincial maps at a scale of 1¼ inches to the mile.

5. Recreational Capability

Recreational capability is similarly mapped by the Government of Ontario for the Federal Government under the A.R.D.A. program, and a map series is published entitled "Land Capability for Recreation" which is at a scale of four miles to one inch. More detailed compilations at a scale of 1¼ inches to the mile were also used in the reappraisal.

Seven classes of land capability for recreation are identified. These, however, do not reflect the quality of the area for recreation, but rather the intensity with which it can be used. Thus a very good beach, capable of being used by many people at one time, might be in Class 1; an excellent area for collecting botanical species might be in Class 3, indicating that too intensive use might lead to its despoilation.

Sub-classes of the seven classes indicate the type of activity that is available in any particular area. Where more than one activity is possible the potentials of each to provide recreation are added together to give the final grading. Thus a low grading overall, e.g. Class 6, means that while an

DESCRIPTIVE LEGEND

is classification the mineral soils are grouped into seven classes on basis of soil survey information. Soils in classes 1, 2, 3 and 4 are idered capable of sustained use for cultivated field crops, those asses 5 and 6 only for perennial forage crops and those in class 7 neither

ome of the important factors on which the classification is based

The soils will be well managed and cropped, under a largely hanized system.

Land requiring improvements, including clearing, that can be made nomically by the farmer himself, is classed according to its limita- or hazards in use after the improvements have been made. Land iring improvements beyond the means of the farmer himself is ed according to its present condition.

The following are not considered: distances to market, kind of ls, location, size of farms, type of ownership, cultural patterns, or resources of individual operators, and hazard of crop damage orms.

he classification does not include capability of soils for trees, tree , small fruits, ornamental plants, recreation, or wildlife.

he classes are based on intensity, rather than kind, of their limita- for agriculture. Each class includes many kinds of soil, and many he soils in any class require unlike management and treatment

SOILS IN THIS CLASS HAVE NO SIGNIFICANT LIMITATIONS IN USE FOR CROPS.

he soils are deep, are well to imperfectly drained, hold moisture and in the virgin state were well supplied with plant nutrients. can be managed and cropped without difficulty. Under good agement they are moderately high to high in productivity for a range of field crops.

ASS 2 — SOILS IN THIS CLASS HAVE MODERATE LIMITATIONS THAT RESTRICT THE RANGE OF CROPS OR REQUIRE MODERATE CONSERVATION PRACTICES.

he soils are deep and hold moisture well. The limitations are erate and the soils can be managed and cropped with little diffi- . Under good management they are moderately high to high in luctivity for a fairly wide range of crops

ASS 3 — SOILS IN THIS CLASS HAVE MODERATELY SEVERE LIMITATIONS THAT RESTRICT THE RANGE OF CROPS OR REQUIRE SPECIAL CONSERVATION PRACTICES.

he limitations are more severe than for Class 2 soils. They affect or more of the following practices: timing and ease of tillage; ing and harvesting; choice of crops; and methods of conservation er good management they are fair to moderately high in pro- vity for a fair range of crops.

ASS 4 — SOILS IN THIS CLASS HAVE SEVERE LIMITATIONS THAT RESTRICT THE RANGE OF CROPS OR REQUIRE SPECIAL CONSERVATION PRACTICES, OR BOTH

he limitations seriously affect one or more of the following prac- : timing and ease of tillage; planting and harvesting; choice of s; and methods of conservation. The soils are low to fair in pro- vity for a fair range of crops but may have high productivity for ecially adapted crop

ASS 5 — SOILS IN THIS CLASS HAVE VERY SEVERE LIMITATIONS THAT RESTRICT THEIR CAPABILITY TO PRODUCING PERENNIAL FORAGE CROPS AND IMPROVEMENT PRACTICES ARE FEASIBLE.

e limitations are so severe that the soils are not capable of use ustained production of annual field crops. The soils are capable roducing native or tame species of perennial forage plants and be improved by use of farm machinery. The improvement practices include clearing of bush, cultivation, seeding, fertilizing or water rol

ASS 6 — SOILS IN THIS CLASS ARE CAPABLE ONLY OF PRODUCING PERENNIAL FORAGE CROPS, AND IMPROVEMENT PRACTICES ARE NOT FEASIBLE.

e soils provide some sustained grazing for farm animals, but the itions are so severe that improvement by use of farm machinery practical. The terrain may be unsuitable for use of farm machinery, e soils may not respond to improvement, or the grazing season be very short

CLASS 7 — SOILS IN THIS CLASS HAVE NO CAPABILITY FOR ARABLE CULTURE OR PERMANENT PASTURE.

This class also includes rockland, other non-soil areas, and bodies of water too small to show on the maps

0 — ORGANIC SOILS (Not placed in capability classes)

SUBCLASSES

Excepting Class 1, the classes are divided into subclasses on the basis of kinds of limitation. The subclasses are as follows:

* SUBCLASS C: adverse climate — The main limitation is low temperature or low or poor distribution of rainfall during the cropping season, or a combination of these

SUBCLASS E: erosion damage — Past damage from erosion limits agricultural use of the land.

SUBCLASS I: inundation — Flooding by streams or lakes limits agricultural use.

SUBCLASS P: stoniness — Stones interfere with tillage, planting, and harvesting.

SUBCLASS R: shallowness to solid bedrock — Solid bedrock is less than three feet from the surface.

SUBCLASS S: soil limitations — Limitations include one or more of the following undesirable structure, low permeability, a restricted rooting zone because of soil characteristics, low natural fertility, low moisture-holding capacity, salinity

SUBCLASS T: adverse topography — Either steepness or the pattern of slopes limits agricultural use

SUBCLASS W: excess water — Excess water other than from flooding limits use for agriculture. The excess water may be due to poor drainage, a high water table, seepage or runoff from surrounding areas

* SUBCLASS X: Soils having a moderate limitation caused by the cumulative effect of two or more adverse characteristics which singly are not serious enough to affect the class rating

CONVENTIONS

Large arabic numerals denote capability classes
Small arabic numerals placed after a class numeral give the approximate proportion of the class out of a total of 10. Letters placed after class numerals denote the subclasses, i.e. limitations

*Denotes class or subclass not present on this map

EXAMPLES

An area of Class 4 land with topography and stoniness limitations is shown thus: 4^{T}_{P}

An area of Class 2, with topographic limitation, and Class 4 with stoniness limitation, in the proportions of 7:3 is shown thus: $2^{7}_{T}4^{3}_{P}$

N.B. The color used for a complex area is determined by the first digit of the symbol. Generally the dominant class appears first in a complex symbol. However, in complexes of two arable classes (1-4) and one non arable class (5-7), the arable classes are shown first if they total one half or more of the map unit

This pattern is overprinted on the color in complex areas, except those having ratios of 8:2, 8:1:1 and 9:1.

FIGURE 1

area might provide excellent recreation opportunities for a limited number of people, too intensive use would lead to it being spoiled. The full descriptive legend is reproduced as Figure 2.

It should be noted that this capability classification does not apply to improved recreational facilities such as golf courses. These are dealt with under Existing Land Use.

6. Urban/Regional Planning

Alternatives are evaluated by regerence to the Toronto-Centred Region Plan, as updated by the Province of Ontario. Two definitive documents on this subject are those published by the Government of Ontario in May 1970 and August 1971. Subsequent refinements to the Plan which were described in the Announcement of the site on March 2, 1972, were made available to the Federal Government and used in the evaluation.

7. Potential for Urban Development

Potential for urban development was estimated on the basis of a number of factors. These include:

- Growth in demand for land for development.
- Suitability for building - all land which is subject to flood, which is too steep, or which exhibits special characteristics, is excluded.
- Ease of access and of servicing, considered in the context and framework of the Toronto-Centred Region Plan.

Criteria Numbers 6 and 7 include the subject matter in the items "6. Servicing Factors" and "7. Land Capability

CANADA LAND INVENTORY
LAND CAPABILITY FOR RECREATION

DESCRIPTIVE LEGEND

Seven classes of land are differentiated on the basis of the intensity of outdoor recreational use, or the quantity of outdoor recreation, which may be generated and sustained per unit area of land per annum, under perfect market conditions.

"Quantity" may be measured by visitor days, a visitor day being any reasonable portion of a 24 hour period during which an individual person uses a unit of land for recreation.

"Perfect market conditions" implies uniform demand and accessibility for all areas, which means that location relative to population centres and to present access do not affect the classification.

Intensive and dispersed activities are recognized. Intensive activities are those in which relatively large numbers of people may be accommodated per unit area, while dispersed activities are those which normally require a relatively larger area per person.

Some important factors concerning the classification are:

- The purpose of the inventory is to provide a reliable assessment of the quality, quantity and distribution of the natural recreation resources within the settled parts of Canada.
- The inventory is of an essentially reconnaissance nature, based on interpretation of aerial photographs, field checks, and available records, and the maps should be interpreted accordingly.
- The inventory classification is designed in accordance with present popular preferences in non-urban outdoor recreation. Urban areas (generally over 1,000 population with permanent urban character), as well as some non-urban industrial areas, are not classified.
- Land is ranked according to its natural capability under existing conditions, whether in natural or modified state; but no assumptions are made concerning its capability given further major artificial modifications.
- Sound recreation land management and development practices are assumed for all areas in practical relation to the natural capability of each area.
- Water bodies are not directly classified. Their recreational values accrue to the adjoining shoreland or land unit.
- Opportunities for recreation afforded by the presence in an area of wildlife and sport fish are indicated in instances where reliable information was available, but the ranking does not reflect the biological productivity of the area. Wildlife capability is indicated in a companion series of maps.

LANDS IN THIS CLASS HAVE VERY HIGH CAPABILITY FOR OUTDOOR RECREATION

Class 1 lands have natural capability to engender and sustain very high total annual use based on one or more recreational activities of an intensive nature. Class 1 land units should be able to generate and sustain a level of use comparable to that evident at an outstanding and large bathing beach or a nationally known ski slope.

CLASS 2 — LANDS IN THIS CLASS HAVE A HIGH CAPABILITY FOR OUTDOOR RECREATION.

Class 2 lands have natural capability to engender and sustain high total annual use based on one or more recreational activities of an intensive nature.

CLASS 3 — LANDS IN THIS CLASS HAVE A MODERATELY HIGH CAPABILITY FOR OUTDOOR RECREATION.

Class 3 lands have natural capability to engender and sustain moderately high total annual use based usually on intensive or moderately intensive activities.

CLASS 4 — LANDS IN THIS CLASS HAVE MODERATE CAPABILITY FOR OUTDOOR RECREATION.

Class 4 lands have natural capability to engender and sustain moderate total annual use based usually on dispersed activities.

CLASS 5 — LANDS IN THIS CLASS HAVE MODERATELY LOW CAPABILITY FOR OUTDOOR RECREATION.

Class 5 lands have natural capability to engender and sustain moderately low total annual use based on dispersed activities.

CLASS 6 — LANDS IN THIS CLASS HAVE LOW CAPABILITY FOR OUTDOOR RECREATION.

Class 6 lands lack the natural quality and significant features to rate higher, but have the natural capability to engender and sustain low total annual use based on dispersed activities.

CLASS 7 — LANDS IN THIS CLASS HAVE VERY LOW CAPABILITY FOR OUTDOOR RECREATION.

Class 7 lands have practically no capability for any popular types of recreation activity, but there may be some capability for very specialized activities with recreation aspects, or they may simply provide open space.

SUBCLASSES

Subclasses indicate the kinds of features which provide opportunity for recreation. They are, therefore, positive aspects of land and do not indicate limitations to use. Features may be omitted from a unit, either because of the imposed three-feature limit, or because their presence was unknown or unconfirmed.

The degree to which these features are judged capable, collectively, of generating and sustaining use for recreation, determines the class. The sequence in which they are listed indicates the order of their significance. Subordinate features may be relatively insignificant and the class of a unit should not be interpreted to indicate the capability of a secondary or tertiary feature.

The subclasses are:

SUBCLASS A—Land providing access to water affording opportunity for angling or viewing of sport fish.

SUBCLASS B—Shoreland capable of supporting family beach activities. In high class units this will include family bathing. In Classes 4 and 5, the activities may be confined to dry land due to cold water or other limitations.

SUBCLASS C—Land fronting on and providing direct access to waterways with significant capability for canoe tripping.

* SUBCLASS D—Shoreland with deeper inshore water suitable for swimming or boat mooring or launching.

SUBCLASS E—Land with vegetation possessing recreational value.

SUBCLASS F—Waterfall or rapids.

* SUBCLASS G—Significant glacier view or experience.

SUBCLASS H—Historic or pre-historic site.

SUBCLASS J—Area offering particular opportunities for gathering and collecting items of popular interest.

SUBCLASS K—Shoreland or upland suited to organized camping, usually associated with other features.

SUBCLASS L—Interesting landform features other than rock formations.

SUBCLASS M—Frequent small water bodies or continuous streams occurring in upland areas.

SUBCLASS N—Land (usually shoreland) suited to family or other recreation lodging use.

SUBCLASS O—Land affording opportunity for viewing of upland wildlife.

SUBCLASS P—Areas exhibiting cultural landscape patterns of agricultural, industrial or social interest.

SUBCLASS Q—Areas exhibiting variety, in topography or land and water relationships, which enhances opportunities for general outdoor recreation such as hiking and nature study or for aesthetic appreciation of the area.

SUBCLASS R—Interesting rock formations.

SUBCLASS S—A combination of slopes, snow conditions and climate providing downhill skiing opportunities.

* SUBCLASS T—Thermal springs.

SUBCLASS U—Shoreland fronting water accommodating yachting or deep water boat tripping.

SUBCLASS V—A vantage point or area which offers a superior view relative to the class of the unit(s) which contain it, or a corridor or other area which provides frequent viewing opportunities.

SUBCLASS W—Land affording opportunity for viewing of wetland wildlife.

SUBCLASS X—Miscellaneous features with recreational capability.

SUBCLASS Y—Shoreland providing access to water suitable for popular forms of family boating.

SUBCLASS Z—Areas exhibiting major, permanent, non-urban man-made structures of recreational interest.

CONVENTIONS

Large arabic numerals denote capability classes.

Upper case letters denote subclasses.

There may be area distortion due to scale limitations, particularly in the case of corridor-shaped units.

* Denotes class or subclass not present on this map.

EXAMPLES

An area of Class 1 shoreland with very high capability to generate intensive family bathing and beach activities, fronting and providing access to a water body suited to family boating, and with a backshore suited to organized camping is shown thus: 1^{B}_{KY}

A complex unit containing Class 5 upland exhibiting diversity of natural landscape and possibilities for gathering and collecting; Class 3 shorelands with capability for lodging and family boating, and Class 5 upland with viewing possibilities and interesting rock formations; in the proportions of 6:3:1 is shown thus: $5^{6}_{J}3^{3}_{NY}5^{1}_{VR}$

FIGURE 2

Summary and Potential Industrial Lands by Class", in the P.P.A. Ltd. report.

8. Comparison with Conceptual Urban Airport Complex

Prototype patterns of urban development in conjunction with a major airport were developed as a basis for comparison of airport sites. The basic concept involves:

- urban development (residential and commercial) in the areas outside flight paths;
- industrial and agricultural uses in those areas which may be affected by flight operations;
- rapid transit linking urban communities and the airport.

The feasibility of implementing such a concept will depend on:

- the potential of the site location for urban development as this relates to the growth in demand for building land.
- the suitability of the site conditions for development in this way.

9. Social and Environmental Implications

The reappraisal takes account of the positive implications of creating employment and stimulating development in support of planning goals, as well as the disturbance to existing population.

10. Comparative Evaluation of Adjacent Lands

In the reappraisal, the use of adjacent lands that could be affected by flight operations has been considered

in a broader context. The desirable patterns for future development of these lands have been outlined in the framework of the planning objectives of the Toronto-Centred Region and more specifically the goals for the form and nature of development in the various parts of the region. These adjacent lands are therefore an important element with integrated planning of the airport and the Region.

EVALUATION OF THE NEW TORONTO AIRPORT SITE

The New Toronto Airport site was evaluated with respect to the criteria listed above. The following is a summary of the findings:

Existing Land Use and Population

Over 90% of the site, and a similar proportion of the lands which may be affected by flight operations, has been cleared for agriculture. The only sizable areas of woodland remaining occupy lands classified as having severe limitations for agricultural purposes, to the north and south of Goodwood. However, the effects of proximity ot the urban area of Metropolitan Toronto are already being felt. Land is changing hands at prices which reflect development potential rather than agricultural capability, and less than 50% of the farms are owner-operated.

All of the other sites considered are largely used for agricultural purposes. The West site rates highest in agricultural production, but land use is being influenced by proximity to Metropolitan Toronto, and many farms are of the recreation

farm type.

There are no conservation areas within the land to be acquired for the new Toronto Airport. The extent to which flight operations may affect conservation areas will not be known definitely until on-site engineering investigations have made it possible for runway locations to be finalized. However, it appears likely that only two may be affected to any significant extent, while five more may be marginally affected. All of the conservation areas are shown by the Canada Land Inventory to be suitable only for outdoor recreational activities of a dispersed nature.

Three golf courses are affected by acquisition. One or two of these may remain in use for a number of years. Two more courses may be affected by flight operations.

The latest estimates indicate that at the the New Toronto Airport less than 2,500 persons will be affected by acquisition; the majority of these will not have to move for a number of years. Exactly how many can remain will depend on the final runway locations. Similarly, the exact number of people who will be affected by flight operations will only be known after on-site engineering investigations are complete and runway locations finalized. The latest estimates confirm that this number will not exceed 2,000 in all, and some of these will not be noticeably affected until the late 1980's.

Of the other sites, the North (or Lake Simcoe site) was rejected primarily because of the large number of persons who would be disrupted. The West site is similar to the Northeast in

terms of numbers disturbed, and at the other sites a somewhat smaller number would be affected.

Agricultural Capability

Almost three-quarters of the New Toronto Airport site is Class 1 agricultural land, the balance being Class 2. However, certain areas are already showing signs of neglect as land ownership changes under the pressure of speculative land purchases.

Over 80% of the lands which may be affected by flight operations are Class 1 and 2 agricultural land. The balance is Class 6 agricultural land with severe topographic and fertility limitations.

There is no doubt that in terms of agricultural capability this site ranks higher than the others considered. However, as has been demonstrated, agricultural soil suitability is declining in importance as a determinant of land use in the Pickering area.

Recreational Capability

Approximately 90% of the New Toronto Airport is Class 6 recreational land. It Could sustain some dispersed activities, e.g. viewing the natural landscape. The remaining 10% of the airport site is Class 5 recreational land, defined as having a moderately low capability for outdoor recreation, again based on dispersed activities.

Approximately 80% of the lands which may be affected by flight operations is Class 6 recreational land, and the balance is Class 5. A very small area of Class 4 land around Musselman Lake may be marginally affected; this land has a moderate capability for outdoor recreation of a general and dispersed nature.

In contrast to all other sites, at the selected location there is no unique recreational opportunity that would be adversely affected by airport development. The North site would affect Lake Simcoe; the East, Lake Scugog; flight operations at the West would affect the Niagara Escarpment, significant acreages of which have been designated as Escarpment Control Lands; and similarly in the Northwest, two areas with good recreation capability would be affected.

In both the Northeast and the West, recreation farming is playing an increasing role as farmers of long standing sell their holdings in response to attractive prices offered.

Urban/Regional Planning

The Northeast and East sites support Ontario's regional planning strategy of providing a stimulus to development east of Metropolitan Toronto, and structuring development along the Lakeshore corridor. The development of the Northeast site also coincides with the phasing of the Province's Design for Development Plan.

The other sites are less consistent with the Provincial urban and regional development goals. The West site in particular would be in conflict with the Provincial Plan.

Capability for Urban Development

Only at the Northeast site and the West site is there significant interest in major urban development in the near future. Both are located in proximity to existing urban centres, and in both increasing land values and the purchase of land by urban interests, reflect plans for more intensive development in the near term.

At both of these sites there is ample suitable land for building, and current and future accessibility is good.

The construction of municipal services such as water and sewers will relate principally to the provisions of the Toronto-Centred Region Plan. The areas to the south and east of the New Toronto Airport are planned to be serviced in the early years of implementation of the Toronto-Centred Region Plan. Such services are not planned for the vicinity of the West site.

Comparison with Conceptual Urban Airport Complex

The development planned in conjunction with the New Toronto Airport represents the Urban Airport Complex as originally envisaged, modified for local site conditions. In integrating the airport with the urban structure of the Toronto-Centred Region Plan, residential development ultimately reaching 200,000 is planned for North Pickering, to occupy the areas south of the airport and which will be unaffected by noise. Industry will be located on lands which may be affected by flight operations, in North Pickering between the residential areas and the airport. Transportation and service corridors will be located where possible under flight paths, It is planned to link the new airport to Toronto and the commercial centres of adjacent urban communities by rapid transit. The balance of the lands which may be affected by flight operations will be planned as open areas between major communities, and be retained for agriculture and other compatible uses.

It will thus be seen that all residential areas in the vicinity of the new airport will lie outside the flight paths, and will not be affected by noise.

The lands to the west and north of the site which may be affected by flight operations are in zone 2 of the Provincial Plan, which is designated for agricultural, recreational and other open space uses. This land is currently used mainly for agricultural purposes which are compatible with flight operations.

Of the other sites, only the West was judged as being well suited for the development of an Urban Airport Complex. However, as noted by the P.P.A. Limited report, Provincial policy does not allow for urban growth of the magnitude envisaged by this concept at any of the other sites including the West.

Social and Environmental Implications

Both the Northeast and the West sites occupy areas where the original social structures have evolved. Farmers are selling their holdings to "recreation farmers," city dwellers are constructing expensive homes along the ravines, and hence the whole nature of the population is changing. In either location airport development would tend to accelerate an existing pattern of change.

The new airport will bring new jobs to the Northeast and broaden the employment base. It will stimulate the new communities planned by Ontario for the eastern part of the Toronto-Centred Region--communities which will be forward looking, and aimed at establishing new standards in terms of the quality of urban life. Only the Northeast site offers this opportunity.

Conclusions

The New Toronto Airport is located on land with a high capability for agricultural and urban purposes. The potential for urban development had been recognized by Ontario, Metropolitan Toronto and the private sector before the airport site was selected, and land had already begun to change hands in anticipation of development.

Recreation farms are a significant and growing feature of the land use of the area. Other Recreation possibilities are limited. The present land use of the area indicates that it is already being influenced by the growth of Metropolitan Toronto.

The co-ordinated planning of airport and adjacent land will ensure that maximum advantage is taken of this opportunity. The Northeast site is the only site for which urban development of the magnitude envisaged is both feasible and in accordance with Provincial Policy. In the planned development of the airport and its environs, this land could be utilised in an appropriate way consistent with its natural characteristics and location.

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Toronto Area Airports System

May 30 , 1972

FINANCIAL IMPLICATIONS OF THE NEW TORONTO AIRPORT

Transport Canada Transports Canada

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ENQUIRIES

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FINANCIAL IMPLICATIONS

Introduction

In 1966, the Federal Ministry of Transport initiated studies on the long range requirements for aviation in Southern Ontario. The first phase of these studies was completed in 1967 and demonstrated that traffic volumes would reach some 20 million passengers by the mid-1980's. The planners proposed a major expansion of the existing airport at Malton to accommodate the growth in traffic. The Government of Canada decided against proceeding with this proposal when it became evident that Malton Airport could not continue to accommodate the forecast growth in traffic beyond the mid-1980's, in view of the great numbers of people who would be disrupted by the expansion that would be necessary.

In December 1968, it was decided that a system of airports would be developed to accommodate the traffic of Southern Ontario. Malton would continue as an important airport but could not be expanded to accommodate all of the air traffic, and a new international airport would be developed. The next phase of these studies was undertaken jointly by the Federal and Provincial Governments and examined alternatives for the aviation plan for Southern Ontario and sites for a possible new international airport. The Federal/Provincial team reported preliminary findings in the fall, 1970, dealing particularly with the evaluation of four sites for the new airport, each being representative of a range of possible sites in a given zone.

Work continued on the aviation plan during 1971 leading to the conclusion announced on March 2, 1972, that Southern Ontario will be most conveniently served by two systems of airports: a Toronto airports system and an airports system for Southwestern Ontario. In the framework of this aviation plan, the site northeast of Toronto has been selected for the new Toronto airport.

In all of this research over the years, the very important aspects of financial feasibility have been examined intensively along with the other pertinent issues such as air safety, passenger convenience, social and environmental change and regional economic development.

This paper describes the results of the examination of the financial aspects. The facts presented demonstrate that the Toronto airports system as proposed is a sound investment and meets every test of financial feasibility.

Investment and The Airports Revolving Fund

Large international airports are vast enterprises. The facilities cater to millions of passengers and accommodate many aircraft costing as much as $25 million each. In this regard, it is interesting to note that while the first phase of the facilities at the new airport will cost approximately $300 million for construction, on a typical day in the early 1980's, only a few years after operations commence, those

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

facilities will accommodate aircraft costing approximately $2 billion.

Activities at an airport employ many people in a wide range of jobs, some in highly sophisticated managerial and technical positions and others in the servicing, maintenance and related fields. By the time of opening of the new airport in the late 1970's, some 20,000 people will be employed at this airport and Malton, and the number is forecast to exceed 35,000 by the mid-1980's.

At airports throughout the world, charges are levied for the use of the facilities. In Canada, charges are based on the frequency and duration of use. The revenue from the charges helps to pay for the operation of the airport facilities. In fact, large international airports can be operated on a financially self-sufficient basis, i.e. revenues earned by the airport are sufficient to meet operating and maintenance costs. In some cases the revenues will be sufficient to recover the capital costs of building the facilities and to meet interest charges.

The Government of Canada is responsible for the provision and operation of aviation facilities in Canada. In recognition of the growing revenues and expenditures from the larger international airports, such as Malton, the Government

established the objective that such airports should be operated on a financially self-supporting basis. In other words, public monies spent would be recovered over the life of facilities through charges established to yield adequate revenues. Under this policy, airport systems which are self-supporting are financed through The Airports Revolving Fund and not from general tax revenues. Should the Revolving Fund need additional capital, Parliament appropriates the monies needed. Interest is paid on the balance outstanding.

Generally speaking, international airports in Canada are self-supporting. Consistent with this policy, the Canadian Air Transportation Administration of the Ministry of Transport established the criteria that the new airport and Malton should be self-supporting and yield a return on the investment at 8% per annum. This paper shows that this objective will be met.

In summary, the expenditures for the airport are a sound financial investment in a needed facility. Money spent will be recovered from revenues from the operation of the airport. The project therefore does not involve spending tax dollars that might otherwise be employed for public works elsewhere in Canada.

Financial Evaluation

The proposed investment of public funds was assessed using the following criteria:

- that planned expenditure be a direct reflection

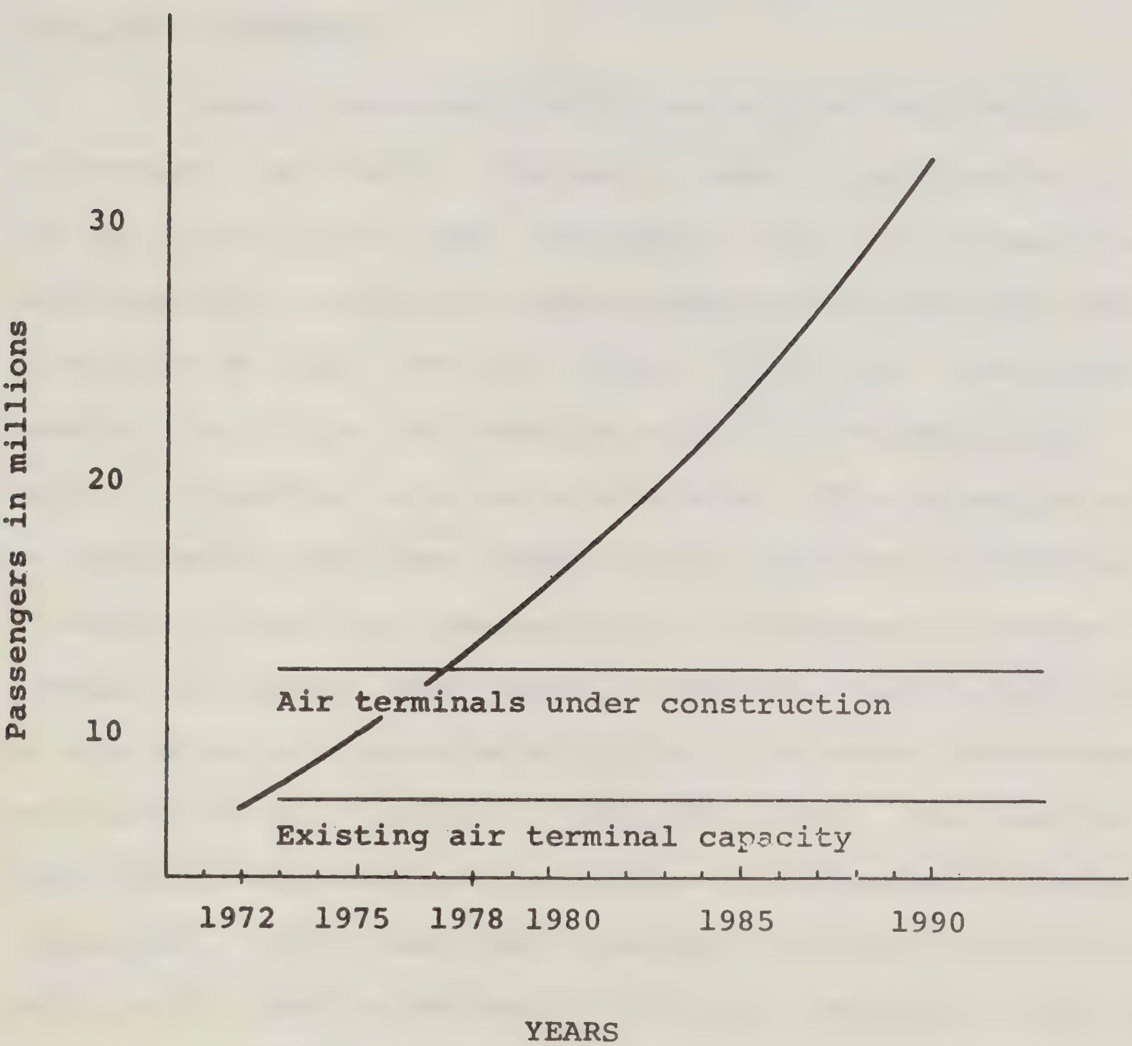
TABLE 1

PROJECTED ANNUAL PASSENGERS

OF THE

TORONTO AREA AIRPORTS SYSTEM

IN RELATION TO THE AIR TERMINAL CAPACITY



of demonstrated requirements for additional airport facilities;

- that the proposed investment be made after evaluation of alternatives, taking full account of comparative costs and benefits;
- that the operation of the airport system be financially self-sustaining over the useful life of the facilities.

Need for Investment

Greatly expanded facilities will be required to accommodate the traffic, whether it were to be directed to the new airport or Malton. Forecasts call for increases to approximately 20 million annual passengers by 1985 and some 30 million by 1990, from the present 7¼ million. Existing terminal facilities for handling aircraft, accommodating people and parking cars are overcrowded. This situation will be improved in the short term with the opening of Terminal 2 at Malton. Even with completion of all stages of the new terminal now under construction at Malton, capacity will only be available for approximately 12 million annual passengers equivalent to the traffic of the late 1970's. The need for these additional terminal facilities is reflected in Table 1 (opposite). It is seen that passenger terminal facilities in addition to those in existence and under construction will be required by 1978 and that, by 1990, additional capacity for a further 24 million annual passengers will be necessary.

These additional terminal facilities would be required in any event, either at the new airport or Malton. Most significant in financial terms, these terminal facilities represent in excess of 80% of the total forecast expenditure to the year 2000.

Table 2 (below) compares in percentage terms the total capital investment at the new airport with that of the full expansion at Malton according to the 1967 Plan. (In fact such expansion is not acceptable, but the comparison is made to demonstrate the financial implications).

TABLE 2

COMPARATIVE COST ESTIMATES (Millions of 1971 dollars)

	New Airport	Expansion Malton
Land	7 %	12 %
Terminals, Internal Roadways, etc.	84 %	82 %
Runways	9 %	6 %
	100 %	100 %

In both cases the total expenditure to the year 2000 is approximately one billion dollars. Approximately $300 million is required to provide facilities at the new airport sufficient to meet demands to the mid-1980's.

There are two significant differences between developing the new airport and expanding Malton; the amount

and cost of land required, and number and cost of runways to be built.

At Malton, some 3,000 acres of extra land to the south-west would have to be acquired for expansion, whereas at the new airport about 18,000 acres can be acquired at approximately half the cost. The long term advantages of the flexibility afforded by this additional land at the new airport, are obvious.

At Malton one additional runway would be required, versus two new runways at the new airport, to ensure capacity at the new airport both in the primary and secondary direction of operations. The one runway at Malton would, however, be relatively more expensive because of the construction difficulties caused by the proximity of Etobicoke Creek. At the new airport the additional runway will provide additional capacity.

Thus the investment for constructing the facilities at the selected site over the next thirty years as compared to those necessary for full expansion of Malton requires the same investment, but provides more flexibility in land area and in runway capacities.

Substantial expenditures would be required to expand the ground transportation facilities to Malton. The selected new airport site takes advantage of existing Provincial

Government plans to develop transportation systems. Notwithstanding the fact that the Federal Government is responsible for airport construction costs and the Provincial Government for transportation systems costs, the more effective use of public funds is to the advantage of the people of the Toronto-Centred Region and Canada.

Phasing of Investment

The future requirements have been estimated for a thirty-year time frame for the purpose of planning and evaluating all implications of the alternate approaches. To satisfy the needs of the near future to the opening of the new airport by the late 1970's, approximately 30 percent of the total thirty-year investment will be necessary. This is demonstrated in the phasing program shown below:

INVESTMENT PHASING

	Expenditures (percentage)
To opening year (1972-1978/79)	30 %
1978/79-1985	14 %
1985-1990	19 %
1990-2000	37 %
	100 %

No decision to commit the majority of the expenditures will be necessary until the 1980's and 1990's, allowing complete flexibility in the allocation of traffic and the development of the new airport. This approach will enable the Government of Canada to decide on future developments when required. In financial terms it simply means that each dollar invested will be conscientiously evaluated before being committed.

Financial Consideration of Alternatives

Studies were also made to evaluate the financial implications of developing the new facilities at each of the alternate sites. Although the total investment required at the various sites was not substantially different, the selected site required less expenditure than others.

A major difference is in the costs of providing the necessary public services to support the operation of the airport: access, transit and road connections and utilities such as water, sewage and hydro. In this regard the selected site was far superior to other sites. The proximity to Lake Ontario means less money needed to build the expensive main lines for services. The site complements provincial transportation plans and will therefore not require great additional expendítues for access.

Financial Viability

The operating costs and the revenues from the facilities were analyzed, in addition to the detailed capital cost analyses. This information provided the basis of a complete evaluation of the financial viability, to determine that the new airport together with Malton would be financially self-sufficient.

The estimates for projected operating costs and revenues are based largely on facts derived from past experience at other major Canadian airports. Airport operating costs and revenues are well defined by the Canadian Air Transportation Administration and detailed policies and procedures have been established for their estimation.

Briefly, operation and maintenance costs are identified for each of the major centres of activity or operational units of an airport, viz:

- terminal buildings
- terminal area (space for car rental, service station concessions, administrative building, etc.)
- airfield (runways, ramps and apron facilities, taxiways, aircraft parking space, etc.)

- industrial area (land rented to hotels, other commercial tenants and industrial concerns)
- car park (indoor and outdoor)
- air navigation and meteorological facilities (air traffic control, tele-communications - primarily the control tower).

The concept of self-sufficiency by type of airport operation enables charges to be levied in relation to the direct use of the facility as well as to overall costs, thereby providing strong financial management and control.

The groups of users of the facilities who provide the revenue through which the airport is funded include the following:

- commercial aviation
- general aviation
- concessionaires (terminal building and area)
- hotels, commercial and industrial tenants
- general public.

Thus, an airport generates revenue from many sources in the form of landing fees levied on airlines and private aircraft, general terminal charges levied for use of terminal facilities, refuelling charges, rent from the many commercial concerns and fees from car parking.

In this way, airports included in the Airport Revolving Fund operate similarly to any other business - they provide services and facilities for which the user is charged. Details of these charges are made available by the Canadian Air Transportation Administration in the publication: Air Services Fees Regulations, Ministry of Transport, Airport and Field Operations Branch.

The financial analysis demonstrated that the two-airport system would operate at a surplus from the opening year of the new airport. Indeed, over the twenty-year period to 1990 the two airports will produce a return on investment in excess of eight per cent, thus enabling them to be completely self-supporting.

Financial Risk

Two very important conclusions are to be drawn.

Firstly, the cost of developing the new airport is virtually the same over the thirty-year period as the costs of expanding Malton according to the 1967 Plan. Everyone understands that Toronto needs additional airport facilities, particularly terminal buildings, and it is just these facilities that constitute the greatest portion of the investment. In other words, investment in the new airport

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is the least costly way to provide the needed facilities, involving the least risk of public funds.

Secondly, the investment is financially sound. The new airport and Malton will operate at a profit. The investment, drawn initially from the Airports Revolving Fund, will not be a drain on public funds, but a sound investment in the public interest.

Development Benefits

In addition to the soundness of the investment, the new airport promises very important development benefits.

Malton cannot be expanded to accommodate all of the traffic to the year 2000 because such expansion would disrupt some 70,000 people, according to counts made in 1967, and some 94,000 according to the 1971 Census. The costs for airport facilities for such expansion according to the 1967 Plan are shown in this paper in order to compare the alternatives in financial terms. It is most significant that these additional 24,000 people have located in areas that are not affected by noise; areas that were promised protection when the decision not to expand Malton was made in December, 1968. This simply means that at Malton it would not be possible to develop the facilities needed, and that the people of the Toronto-Centred Region would suffer from not having the

same opportunities to fly to visit families and vacation spots, and for business. The commerce of this region would suffer accordingly.

The air traffic at Malton will continue to be restricted. These restrictions will become increasingly annoying for the travelling public and increasingly more prohibitive to the airlines seeking to maximize the use of very costly aircraft.

The 1967 Malton plan provided for expansion to the mid-1980's and slightly beyond, but flexibility would be severely limited by the lack of additional land for further airport development. At the new airport, at the same cost, flexibility is achieved that will permit meeting the unforeseen demands of the future. At the same time, initial costs are no higher and each stage of expenditure can be evaluated prior to commitment.

The total capital costs of expanding Malton exceed the capital costs of developing the new airport, largely as a result of the additional urban roads required to handle all of the ground traffic that would be concentrated at the one point at Malton. In this regard, the combined roles of the new airport and Malton make better use of the existing and planned provincial transportation networks. It is interesting

to note that airport access is a major factor limiting capacity at Kennedy, O'Hare and Los Angeles International, the three largest airports in the United States. Malton would reach this situation by the mid to late 1980's.

Most important, is the enhancement or avoidance of deterioration of the quality of life for many, now and in the future. At the new airport, all the land that will ever conceivably be affected by flight operations, by noise and other factors, will be controlled so that future urban development will be compatible. This planned protection of the community is possible because development has not yet taken place. At Malton, retroactive protection over designated areas is just not possible. The 1969 zoning applies to the existing three runways and makes allowance for the traffic to the mid-1970's. Beyond that the situation would deteriorate for great numbers of people. At the new airport, protection and flexibility to accommodate unforeseen developments are provided.

In summary, the Toronto-Centred Region will have an airport system with a new airport that will be able to handle the growth of the future, will avoid the disturbance to the community that expanding Malton would entail, and will achieve all of the other benefits at the same cost.

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Toronto Area Airports System

May 31, 1972

AIRCRAFT MOVEMENT FORECASTS AND THE NEW TORONTO AIRPORT

Transport Canada Transports Canada

Air Air

Transport Canada | Transports Canada

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ENQUIRIES

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AIRCRAFT MOVEMENT FORECASTS

BACKGROUND

Forecasts of all aspects of aviation activity were prepared and used in the planning of the development of the system of airports for Toronto. Forecasts of passenger and cargo volumes were compiled to provide a preliminary indication of the extent and timing of new facility requirements. Estimates were then made of the number of air carrier aircraft movements, taking into account the anticipated size and mix of the aircraft. To provide a total picture of the aircraft activity, forecasts of general aviation movement were also prepared.

In establishing the aviation plan for the Toronto area, four forecasts of aircraft movements were prepared from 1968 to 1971. In the first three forecasts (dated December 1969, September 1970 and May 1971), studies were made of all segments of aviation activity (passenger and cargo volumes, air carrier aircraft movements and general aviation). The fourth forecast, completed in November 1971, concentrated specifically on air carrier passenger aircraft movements, and was

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prepared as a revision to the aircraft movements section of the previous May 1971 forecast to take into account more up-to-date information on load factors and the probable sizes of future aircraft and to extend the scope of the fleet mix forecast from 1990 to 2000.

The number and types of aircraft together with the forecasts of passengers and cargo are the basis of determining the land area required for airport facilities: terminal buildings, aircraft parking areas, runways and ground access. They are also the basis for measuring the impact of the flight operations on adjacent communities.

The 1967 plan to expand Malton to accommodate the forecast aviation activity contemplated acquisition of additional land which would be committed to the accommodation of terminal building and aircraft parking areas. It was very evident that noise from the increased flight operations would cause massive disruption in adjacent communities. In consequence, therefore, it was decided that a new airport is required because of the forecast aircraft movements as detailed in this paper.

The purpose of this document is to review the aircraft movement forecasting techniques that have been used by the Project Team and to summarize the results obtained. Some information is provided on other types of aircraft activity in the Toronto area, such as general aviation, so as to give a total picture of the level of anticipated movements.

FORECASTING AIRCRAFT MOVEMENTS

The forecasts of aviation activity for the Toronto area were prepared for the period to the year 2000. This is consistent with the forecasting and planning of all facets of the development of the region by Government and, particularly, the Toronto-Centred Region Plan by Ontario.

Within this planning time frame, one can be most specific about the forecasts up to the late 1980's, which coincides with the initial and intermediate development period for the new airport. For this period, predictions on the aircraft operating in the Toronto area are reasonably certain.

Prior to the introduction of jet aircraft in the late 1950's, average aircraft life in airline service was about ten years. With the introduction of the jets, the characteristics of the air carrier industry changed markedly. The substantial advantages provided by the jets in terms of speed, comfort, size and more economical operations forced a very rapid change in the fleet composition of the world's airlines in the face of competitive pressures. It now appears that these jet aircraft can continue in service for a longer time period. However, even with this continued use of the jets of the Sixties we are now experiencing introduction of another generation of jets - the wide-bodied 747s and trijets. This means that many of the aircraft presently in service and most of those about to come into service will be operating over the period through the late 1980's.

In addition, the airlines are now applying more sophisticated planning and analysis to their long-term developments and have much firmer ideas about their likely fleet composition for the 1970's and their aircraft needs for the 1980's. Many of the new aircraft to be

introduced over the next few years are in advanced stages of design (for example, longer range versions of the wide-bodied trijets, and larger models of the B-747).

Based on these reasonably firm forecasts for this period to the late 1980's, it is demonstrated that significant expansion of the boundaries of Malton Airport would be required, particularly to park and handle the dramatically increased number of aircraft in the peak periods. It is further shown that the great increase in the number of flights, particularly the heavily-laden, long-haul flights of large jets in the summer would cause drastic increases in the area and in the numbers of people that would be affected by noise.

Beyond the late 1980's up to the year 2000, the forecasts are somewhat less definitive. However, they are based on the informed judgements of the forecasters, the manufacturers and the airlines as to the likely trends in aircraft size, design and operations. For planning expansion of the new airport beyond the first phase, new forecasts of aircraft movements will be prepared at later dates. Notwithstanding, the forecast traffic will increase beyond the 1980's and will further validate the decision made to build a new airport.

FACTS OF AIRCRAFT MOVEMENTS - TORONTO AREA

In preparing the four forecasts used by the Project Team, two different methodologies have been used. In the December 1969 forecast, statistical analyses were made on actual aircraft movement data of the 1960's to produce historical growth rates. From these trends, future growth rates were developed which were subsequently modified to reflect anticipated changes in economic and aviation activity in the Toronto area.

In preparing the September 1970 forecast, a formula was used which related the three main variables: anticipated passenger volumes, the average seating capacity of passenger aircraft and load factors. (Load factor is the total number of passengers carried expressed as a proportion of total seats available). This mathematical relationship which was developed in the preparation of this second forecast, was also used for the May and November 1971 forecasts with only minor modification to reflect the slightly higher proportion of arriving over departing passengers in the Toronto area.

In developing the May 1971 aircraft movement forecast, the inputs for all three variables in the formula were up-dated based on a new forecast of passengers for the Toronto area and more recent information on the probable load factors and average aircraft seating capacities.

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Estimates of new load factors for the forecast period were derived from a study of past passenger load factor data which was prepared by the Aviation Statistics Centre. In preparing the revised average seating capacities, the mix of aircraft types in use and the seating capacity of each type used in the September 1970 forecast were reviewed and revised where necessary.

In the November 1971 forecast, most of the previous information used in the formula was found to be valid, but the average aircraft seating capacity variable was changed to reflect new information on the probable upper limits in aircraft size over the later years of the forecast period. Analysis had shown that the load factor assumptions and anticipated passenger volumes used in the May 1971 forecast were reasonable indications of the probable level of activity. The first step in the November 1971 forecast was the development of revised average aircraft seating capacities for the different types of aircraft operating in each passenger flight sector. A new movement forecast was developed using these revised seating capacities. This was achieved by analysing the number of passengers forecast to be carried by each type of aircraft in each flight sector to arrive at a revised estimate of the total aircraft operating in the Toronto area.

Details of the passenger forecasts used in developing these aircraft movement forecasts are outlined in separate discussion papers prepared by the Project Team.

LOAD FACTORS

Forecasts of passenger load factors were derived from an analysis of past data by major passenger sector, from consultations with airlines as to their probable load factors. Airlines adjust their operations on the basis of attaining average load factors which will provide a reasonable return on their operations and will also ensure adequate levels of service (reasonable flight frequency and seat availability) for their passengers. A good example of the adjustments made by the airlines is on the international sector where the number of passengers travelling on certain routes varies considerably with the seasons. Airlines adjust to the decreased number of passengers during the low seasons by reducing the number of flights. However, certain minimum levels of service must be maintained. For example, during the busy summer season, an airline will probably provide at least one return trip per day between Toronto and each of several European cities. During the off-season, the number of flights on the same route may be reduced to only two or three per week. As well, the low season in Europe occurs

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at the same time as the peak season in the Caribbean and vice-versa, so that the airlines can divert equipment from one set of routes to the other and thus maintain overall fleet utilization and load factors.

This flexibility has recently led to the possibility of airlines sharing expensive aircraft, with one airline operating the aircraft to the Caribbean in the winter, and the other to Europe in the summer.

The following table shows the resulting load factor estimates used in preparing the May and November 1971 aircraft movement forecasts:

TABLE 1

PASSENGER SECTOR	FORECAST PASSENGER LOAD FACTORS ON FLIGHTS ORIGINATING AND TERMINATING AT TORONTO AIR CARRIER AIRPORTS 1970-2000
Scheduled flights to/from Canadian cities	0.60
Scheduled flights to/from United States cities	0.50
Scheduled flights to/from international cities	0.55
Charter flights	1.00

Domestic load factors forecast are generally higher than North American and international load factors. This reflects the degree of efficiency attainable in circumstances where passenger and cargo demands can be met with a relatively high degree of flexibility, both in terms of flight frequencies and aircraft types employed. It also reflects efficiencies that flow from regulated competition. North American load factors are constrained by restrictions contained in, and the competitive elements characteristics of, bilateral air agreements. Limited frequency requirements in international service permit certain efficiencies not attainable on all North American routes. Charter flights are usually sold on the basis of full aircraft loads, thus the 100 percent load factor.

AVERAGE PASSENGER AIRCRAFT SIZE

Estimates of average aircraft seating capacities were derived by a route by route analysis of likely types of aircraft to be used, probable aircraft size and anticipated flight frequencies based on assumed load factors and passenger forecasts. The resulting values for the individual routes were then aggregated into major flight sectors. Tables 2A and 2B following show the results

of the analysis of aircraft seating capacities by flight sector for the May and November 1971 movement forecasts. In the last passenger sector, it will be noted that charter aircraft estimates are not separated from the international totals. In terms of aircraft seating capacity, it is not meaningful to separate charter from the other international flights as carriers serving these two markets use the same types of aircraft in most cases, particularly with the increased involvement of the scheduled carriers in this charter market.

TABLE 2A

MAY, 1971 FORECAST

AVERAGE AIR CARRIER PASSENGER AIRCRAFT SIZE

TORONTO AREA AIRPORTS

(NUMBER OF SEATS - MULTIPLE CLASS SEATING)

	1970	1975	1980	1985	1990	1995	2000
RANGE OF AIRCRAFT SIZE	50-370	90-370	100-375	110-385	120-400	--	--
OVERALL AVERAGE SIZE	105	139	174	214	253	286	319
BY PASSENGER SECTOR							
Scheduled flights to/from Canadian cities	106	140	172	203	235	270	300
Scheduled flights to/from United States cities	96	125	160	202	238	275	312
Scheduled and charter flights to/from other international cities	157	200	249	298	348	400	455

TABLE 2B

NOVEMBER, 1971 FORECAST

AVERAGE AIR CARRIER PASSENGER AIRCRAFT SIZE

TORONTO AREA AIRPORTS

(NUMBER OF SEATS - MULTIPLE CLASS SEATING)

	1970	1975	1980	1985	1990	1995	2000
RANGE OF AIRCRAFT SIZE	50-370	90-450	100-600	110-700	120-800	120-900	120-1000
OVERALL AVERAGE SIZE	103	140	178	221	268	305	328
BY PASSENGER SECTOR:							
Scheduled flights to/from Canadian cities	94	136	173	205	244	273	287
Scheduled flights to/from United States cities	103	128	159	205	240	265	280
Scheduled and charter flights to/from other international cities	163	203	253	309	404	490	526

As can be seen, average passenger aircraft size is expected to increase substantially over the forecast period. This is particularly evident for the international segment which is the most rapidly growing part of the market. As well, the difference in size between the largest and smallest aircraft in service will increase. However, these increases will not be as great as was anticipated a few years ago when it was said aircraft carrying 1,500 passengers and more would be flying in the 1990's.

Aircraft Mix

One of the major measures of aircraft activity generated in the course of the overall aircraft movements forecasting process is the aircraft mix or share of movements by aircraft type. This measure plays an important role in the planning program as it provides information on the numbers and types of aircraft which must be accommodated at the Toronto air carrier airports. In analyzing the probable aircraft mix, aircraft were assembled into groups according to approximate seating capacities. The results of this analysis are shown in Table 3 following. As can be seen, the larger aircraft (over 250 seats) are forecast to make up the major share of the total movements after 1985. However, it should also be noted that the 100 - 120 seat aircraft will continue to play an important role serving many of the short-haul routes such as Windsor, London and Northern Ontario and supplementing the large aircraft on the high density routes.

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TABLE 3

FORECAST OF AIR CARRIER

AIRCRAFT MIX FOR TORONTO AIRPORTS

	PERCENT OF ANNUAL MOVEMENTS					
AIRCRAFT GROUP	1975	1980	1985	1990	1995	2000
100 - 120 seats (DC-9, B-727 types)	55%	46%	37%	32%	27%	23%
150 - 200 seats (DC-8, B-707 types)	30%	23%	15%	7%	3%	3%
250 - 320 seats (L-1011, DC-10 types)	12%	24%	37%	50%	58%	61%
350 plus (B-747, later larger jumbos)	3%	7%	11%	11%	12%	13%

Evident in the changing aircraft mix is the trend to more specialized uses for particular aircraft: the large wide-bodied aircraft on high-density routes and smaller aircraft permitting reasonable flight frequencies on the lower-density feeder routes. This accounts for the reduction in the use of 150-200 seat aircraft (DC-8/B-707 type). This type is a middle-sized aircraft now employed for a great variety of purposes. This flexibility has been useful in the development of the jet age to date and will have certain major on-going roles (charter, cargo), during the next few years.

To provide additional insight into the aircraft movement forecast, analysis was done of the possible impact of increasing the number of movements or changing the mix of operating out of two major air carrier airports instead of one. In order to assess the effect, a detailed examination was made of several roles that the two airports might play. Major traffic sectors, such as all international including the Caribbean, were assigned to the new Toronto airport and an allowance made for additional services that might be provided by the airlines to handle connecting passengers. It was shown that the traffic could be handled with the forecast mix of aircraft types. A very small number of repositioning flights would be necessary between the two airports, few passengers would be forced to move from airport to airport and few airlines would require duplicate facilities and services.

SUMMARY OF TORONTO AIRCRAFT MOVEMENT FORECASTS

Tables 4A, 4B and 4C summarize the results of the four forecasts of air carrier passenger aircraft movements for the two Toronto airports. In all cases the base year used for actual results was 1969 or earlier and, therefore, the year 1970 is a forecast, not a report on actual results. The actual results of 1970 were in fact higher than forecast. Of note is that the most recent forecast, when compared to the initial forecast (December 1969), shows more flights in the short term and fewer in total in the long term. This is the result of two factors:

1. Longer use of existing aircraft and, particularly, the smaller sizes in the short term. This assumption is corroborated by the more recent announcements of aircraft equipment plans by airlines which showed introduction of the wide-bodied aircraft.

2. Greater increase in aircraft size in the long term, particulary in the international long-haul segment which is the most rapidly growing part of the air carrier market.

In comparison to the growth predicted in annual passengers over the forecast period, the growth in aircraft movements is substantially lower. The annual number of passengers is forecast to grow by almost ten times over the period from 1970 to 2000, whereas air carrier aircraft movement are forecast to increase just under three times. The lower growth rate in aircraft movements is due to the constantly increasing average size of the aircraft in use. The effect of this increasing size is most notable in the international sector.

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TABLE 4A

FORECASTS OF AIR CARRIER PASSENGER AIRCRAFT MOVEMENTS

TORONTO AIR CARRIER AIRPORTS

(THOUSANDS OF ANNUAL MOVEMENTS)

	DECEMBER 1969 FORECAST				SEPTEMBER 1970 FORECAST		
	1970	1975	1980	1990	1985	1990	2000
Scheduled flights to/from Canadian cities					75		
Scheduled flights to/from United States cities					61		
Scheduled and charter flights to/from other international cities					30		
TOTAL FLIGHTS	106	131	155	203	166	204	346

TABLE 4B

FORECASTS OF AIR CARRIER PASSENGER AIRCRAFT MOVEMENTS

TORONTO AIR CARRIER AIRPORTS

(THOUSANDS OF MOVEMENTS)

	MAY 1971 FORECAST						
	1970	1975	1980	1985	1990	1995	2000
Scheduled flights to/from Canadian cities	60	65	71	82	93	110	132
Scheduled flights to/from United States cities	44	54	65	71	81	92	105
Scheduled and charter flights to/from other international cities	9	14	21	28	36	46	61
TOTAL FLIGHTS	113	133	157	181	210	248	298

TABLE 4C

FORECASTS OF AIR CARRIER PASSENGER AIRCRAFT MOVEMENTS

TORONTO AIR CARRIER AIRPORTS

(THOUSANDS OF MOVEMENTS)

	NOVEMBER 1971 FORECAST						
	1970	1975	1980	1985	1990	1995	2000
Scheduled flights to/from Canadian cities	60	65	71	81	88	104	125
Scheduled flights to/from United States cities	44	54	65	70	81	95	115
Scheduled and charter flights to/from other international cities	9	14	21	27	31	38	53
TOTAL FLIGHTS	113	133	157	178	200	237	293

International long-haul is the most rapidly growing segment of passenger activity. However, much of the very rapid growth in passengers in this sector will be offset by the use of increasingly larger aircraft.

An analysis of recent actual aircraft movement statistics shows that activity is slightly higher than that forecast. In 1970, there were about 118,000 air carrier scheduled and charter movements reported at Toronto International Airport as compared to a forecast of 113,000. This greater activity supports the finding of the November 1971 forecast that growth in the short term would be more than that originally predicted in the December 1969 forecast.

FORECAST OF PEAK HOUR ACTIVITY

Forecasts of peak hour activity are generated in conjunction with the forecasts of overall movements and provide valuable information on the number of aircraft which must be accommodated at the busiest periods in a year. Airport facilities must be built to handle these peak requirements rather than the average hourly volumes. Table 5 below outlines the forecast of peak hour air carrier movements in the Toronto area. Peak hour

movements are forecast to increase by just over three times from 1970 to 2000 which is higher than the growth estimated for total air carrier movements. This higher growth is due to the greater number of international flights, particularly those to Europe which must operate during certain periods because of the time zone differences and curfew restrictions.

The larger aircraft in international service create a great load on airport facilities in a short, busy time period.

This sort of traffic makes a much greater demand upon airport land areas than that at airports such as Chicago's O'Hare where domestic traffic predominates.

In the peak mid-summer season, the heavily-laden aircraft climb slowly in the thinner air causing maximum disturbance among those enjoying outdoor living.

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TABLE 5

YEAR	MAY 1971 FORECAST OF PEAK HOUR AIR CARRIER PASSENGER AIRCRAFT MOVEMENTS - TORONTO AIR CARRIER AIRPORTS
1970	35
1975	42
1980	51
1985	60
1990	71
1995	86
2000	107

AIR CARGO

Air cargo movement forecasting is particularly difficult. Both the demand for air cargo capacity and the availability of aircraft are difficult to assess. For instance, a mix of freighter aircraft plus the belly capacity of passenger aircraft is used to carry cargo. However, if the available cargo proves to be too much for the belly space available, it may not be practical to use freighter aircraft and the demand may be satisfied by other modes of transport.

Forecasts of freighter movements were derived by dividing the total forecast volume of cargo to be carried in freighter aircraft by the anticipated average loads of the freighter aircraft. Table 6 below outlines the results of this analysis. As can be seen, the forecast number of freighter aircraft movements in the Toronto area is only a small percentage of the movements estimated for passenger aircraft.

TABLE 6

YEAR	JANUARY 1972 FORECAST OF FREIGHTER AIRCRAFT MOVEMENTS - TORONTO AIR CARRIER AIRPORTS (THOUSANDS OF ANNUAL MOVEMENTS)
1970	1.3
1975	2.1
1980	4.2
1985	8.6
1990	14.3

GENERAL AVIATION

At Canadian airports with Ministry of Transport control towers, aircraft movements are recorded by the Aviation Statistics Centre according to the class of operation. The following table shows this breakdown for Toronto International Airport for 1970:

TABLE 7

TORONTO INTERNATIONAL AIRPORT
AIRCRAFT MOVEMENT BY
CLASS OF OPERATION - 1970

Itinerant Movements:			
- Air Carrier	- scheduled	114,930	
	- charter	3,019	
		117,949	117,949
- Other itinerant	- commercial	20,013	
	- private	35,958	
			55,971
Local Movements (aircraft remains at all times within airport tower control zone):			31,158
Government:			
- Civil			2,130
- Military			561
Simulated Instrument Approaches:			13,227
		TOTAL	220,996

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For Toronto International Airport, the other itinerant movements have been used as a measure of the level of general aviation activity. When this value is compared to the total estimated general aviation activity in the Toronto-Centred Region, it can be seen that general aviation activity at Toronto International is quite small. For example, the following table shows the estimate of 1970 activity at Toronto International as compared to that at several of the major general aviation airports in the Toronto-Centred Region.

TABLE 8

	ESTIMATED GENERAL AVIATION MOVEMENTS - 1970	
Toronto International (other itinerant movements only)		55,971
Totals for:		
Toronto Island	190,370	
Buttonville	192,320	
Oshawa	91,828	
Hamilton	169,265	
Waterloo-Wellington	80,741	
Total for five airports	724,524	724,524

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Forecasts of general aviation activity for the Toronto hub (11 airports including Toronto International) were prepared on the basis of other itinerant movements only. These forecasts are outlined below. It can be seen that the hub forecast is much lower than the actual total for the five general aviation airports in the table below. However, the hub forecast does not include a forecast of local movements. Forecasts of general aviation local movements in general have been found to be extremely unreliable and misleading on an annual basis due to the volatile nature of this segment of air traffic and are therefore not included.

TABLE 9

YEAR	GENERAL AVIATION AIRCRAFT MOVEMENT FORECAST - TORONTO HUB (Thousands of Annual Movements)
1970	203
1975	310
1980	416
1985	520
1990	629
1995	760
2000	940

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General aviation activity at Malton was not a factor in the decision that a new airport was required. The proportion of general aviation movements to air carrier movements at the major air carrier airports is not forecast to increase substantially over the forecast period. As well, general aviation aircraft are considerably quieter than their air carrier counterparts. It is anticipated that over time the majority of general aviation movements at the two major airports will become primarily associated with corporate aviation operations.

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Toronto Area Airports System

June 12, 1972

PEOPLE, MALTON AND THE NEW TORONTO AIRPORT

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PEOPLE, MALTON

INTRODUCTION

The decision to limit the size of Toronto International Airport, Malton, was based in part upon the fact that full expansion was shown to have a highly negative social impact upon the residents of the communities in the surrounding area.

The 1967 Master Plan for Malton, which was announced by the Minister of Transport in 1968, showed that Malton could be expanded to meet the traffic to 1986 and beyond only by almost doubling its size. It concluded that the viability of proceeding depended on three important preconditions:

1) that additional land was available for expansion, taking into account planned and potential uses for other purposes;
2) that an adequate ground transportation system could be provided, taking into account existing highways and provincial plans for the future; and
3) that land use compatibility could be satisfied with respect to the communities surrounding the airport, taking into account potential conflict between existing and planned uses for the land and constraints on use which would result from flight operations.

The additional land was required to permit the construction of additional terminals, aircraft parking areas, aprons and other facilities including a major runway in the north-south direction to be known as 14R-32L. The addition of this runway to Malton would have immediately necessitated closing the section of Dixie Road that is nearest to the airport. More importantly, the con-

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struction of this fourth runway would have had far-reaching, long-range effects of a socially disruptive nature on the residents and community structures of the area that would be in the vicinity of flight paths of aircraft using Runway 14R-32L. Included in this area are a part of Mississauga and a portion of Chinguacousy.

In addition to those who would be affected by the construction of the new runway, further areas would have been affected by the increase in traffic using the three existing runways. Additional parts of Mississauga, Etobicoke and part of the Town of Streetsville would have been threatened by the effects of flight operations.

The 1967 Master Plan showed, in sum, that the proposed expansion of Malton could be accomplished but to the detriment of 70,000 people. Measurements of the effects of flight operations showed that these people reside in areas that lie within the 100 CNR (Composite Noise Rating) Contours. (The paper "Aircraft Noise and the New Toronto Airport" explains the CNR System.) These 70,000 people could expect to face an increasing degree of social disruption with the growth of air traffic over the next two or three decades.

In December 1968, the Government of Canada decided against the full scale development of Malton because the preconditions of land use compatibility could not be fulfilled. When this decision was announced it received widespread public support.

TABLE 1

Etobicoke		
(a) Number of persons already living within the noise sensitive areas -------------	35,100	
(b) Potential population under the existing Official Plan ------------------------		42,100
Mississauga		
(a) Number of persons already living within the noise sensitive areas -------------	24,800	
(b) Potential population under the existing Official Plan ------------------------		81,100
Streetsville		
(a) Number of persons already living within the noise sensitive areas -------------	3,000	
(b) Potential population under the existing Official Plan ------------------------		7,000
Chinguacousy		
(a) Number of persons already living within the noise sensitive areas -------------	6,000	
(b) Potential population under the existing Official Plan ------------------------		60,000
TOTALS	68,900	190,200

Nevertheless, the Plan for Malton did establish that the facilities at Malton could be expanded to accommodate the traffic of the 1970's within the existing airport boundary. It was determined that this expansion could be achieved with increasing size of aircraft resulting in fewer flights and the expectation that increasing use will be made of quieter engines. Consequently an interim development plan was evolved: it would permit Malton to accommodate traffic to 1978-79 (the earliest date at which a new airport could be opened).

Once the decision to limit the size of Malton had been taken, the Federal and Provincial Governments worked together to minimize the effects of the airport on the surrounding lands. The Ministry of Transport developed new operational regulations designed to ensure that, with the traffic volumes envisaged, existing developed residential areas would be subject to the least possible aircraft noise commensurate with the safe operation of the airport. The two governments co-operated to produce guidelines for land use which would ensure that future occupation of land outside the airport boundaries would be compatible with the anticipated noise levels produced by flight operations in the mid to late 1970's. Ontario introduced controls to implement these guidelines in October 1969, and since that time all development in the specified areas has been subject to these controls.

This paper examines in greater detail what would be the social costs of expanding Malton to the fullest extent

proposed and updates the population figures that were assembled in 1968.

THE MASTER PLAN, 1967

When this Plan was announced in 1968 a special Federal/Provincial/Municipal Committee was formed to examine the impact of airport expansion in terms of adjacent land use potential. This Committee was chaired by officials of the Ministry of Transport and the membership was comprised of representatives of the Ontario Department of Municipal Affairs and of all the municipalities that would be affected (i.e. Metropolitan Toronto, Etobicoke, Mississauga, Streetsville, Chinguacousy and Brampton).

Representatives of each of the municipalities estimated the number of persons presently living in areas that would be affected by noise in 1985. They also assessed the number of persons who could ultimately be expected to live in those areas unless existing approved Official Plans were changed and controls introduced to limit residential development. The estimates are shown on Table 1 opposite.

In 1968 the total existing population living in areas that would be affected by noise in Chinguacousy, Streetsville, Mississauga and Etobicoke was 68,900. At that time, the total future population planned for this same area was 190,200.

Consequently, in December 1968, the Government of Canada, concluding that too many were already in residence for the precondition of land use compatibility to be met, announced the decision not to proceed with the full expansion of Malton.

Management of Land Adjacent to Malton

Following the decision, Federal and Provincial officials continued discussions to determine ways to minimize the effects of present and future noise on surrounding areas. The Federal Government developed new flight operational regulations. Together the two Governments established guidelines, using the CNR system. The Provincial Government introduced appropriate controls under the Planning Act.

On October 9, 1969, the Minister of Municipal Affairs in announcing the land use compatibility controls referred to the flight operational regulations as follows:

> The operational regulations are designed to ensure that existing developed residential areas will be subjected to the least possible aircraft noise commensurate with the safe operation of the airport, taking into consideration such factors as meteorological conditions and the existing and future volume of aircraft movements.

He then presented a plan based on the CNR system that used as a basis human response to aircraft noise. Contours representing the various levels of exposure to noise annoyance were superimposed on a map of the area. (See map in Appendix 1) These contours represent the degree of response to be expected in various locations in the communities concerned. They are developed from observation and measurement of the physical noise environment and also take into consideration the magnitude of the noise, the number of occurrences per day, the time of day the noise occurs and the effect these factors have in causing

irritation to human beings.

The CNR contours were used to define zones, for which the Department of Municipal Affairs developed a Land Use Compatibility Table that establishes criteria for land use development in each of the zones. (See Table in Appendix 1; the table identifies appropriate land uses in each of the sensitivity zones that are compatible with the noise levels expected zone by zone.)

The Minister of Municipal Affairs discussed the intentions of the flight operational regulations and the Land Use Compatibility Table and plan during his speech of October 9, 1969, stating their objectives as follows:

(1) to ensure that the effect of aircraft noise on existing built-up areas in minimized;

(2) to ensure that land which is affected by aircraft noise now, or in the future, is developed only with compatible uses and not for uses which will subject individuals to unacceptable noise levels;

(3) to inform the public so that private capital will not be invested in land which cannot be developed to its full extent because of aircraft noise;

(4) to ensure the future operation of Toronto International Airport, to its optimum capacity, so that it will continue to perform its social and economic function, which is of national and provincial as well as of local importance.

Using the 1971 Census the Ministry of Transport has recalculated the number of persons living within the area who would be affected by the noise. The following procedure was employed:

- Noise contours were superimposed on maps showing the Census Enumeration Areas.
- The percentage of each affected Enumeration Area that lies within the area affected by flight operations was determined by examination of recent air photographs.
- The total population of each Enumeration Area was then multiplied by the percentage affected by noise.

The numbers in each Enumeration Area were added to give the total of 38,000 people affected. This total compares with the original count of approximately 35,000 people and therefore shows that the controls have been largely successful.

In sharp contrast, in the adjacent areas which would have been affected by noise from the full expansion, and which were not controlled because of the decision to limit Malton, residential development has been proceeding some seven times as fast. The increase in these areas over the three years is approximately 22,000. The total number that would now be affected by the full expansion of Malton in accordance with the 1967 Master Plan is in excess of 94,000 compared with the original figure of 68,900.

POTENTIAL SOCIAL DISRUPTION

Residential

The Development Controls and Land Use Compatibility Table promulgated by the Province of Ontario accurately forecast the extent and degree of severity of the noise impact of flight operations from traffic anticipated in the mid to late 1970's.

However, if the Minister of Transport's December 1968 decision to limit the expansion of Malton were to be reversed and the 1967 Master Plan were adopted in its entirety, there would be more disruption caused in two areas.

Firstly, the noise levels within those areas designated in October 1969 would increase significantly.

Secondly, construction of the fourth runway would mean that an additional large area of land and great numbers of people not now disrupted would be subjected to noise. In the area of the flight path and vicinity of runway (14R-32L) the rate of development has been one of the highest in the Toronto-Centred Region. (See New Assessments in Appendix 2.) No operational controls were imposed in this area in 1969 because plans for the fourth runway were cancelled with the decision to limit Malton. By 1971 the population had increased by more than 35 per cent over the late 1968 figures. This area includes the growing "New Town" development at Bramalea which in 1968 had a population of less than 16,000. By 1969 the population had grown to 20,000, in 1970 to 23,000, and by 1971 to 25,000.

Using the methodology described above, in May 1972 the Ministry of Transport recalculated the total number of persons presently living in the area that would be affected were the 1967 Master Plan to be implemented. The total population in that area exceeds 94,000, which is a significant increase over the fall/1968 total of 68,900.

The majority of this growth in residential development has taken place in those parts of Etobicoke, Mississauga and Bramalea which are outside the present land use controls, but within the area which would be affected by flight operations under the Master Plan of 1967. New residents of these communities moved into their homes with the promise that they would not be affected by Malton's flight operations.

The trend will continue. Within the boundaries of the area that would be affected by noise if Malton were to be fully expanded are two other "New Town" developments: Meadowvale and Mississauga City. Both are presently in the early stages of construction, but it is expected that by 1980 each will contain a population of at least 100,000, or a combined total of 200,000 - 250,000 people.

If Malton were expanded, some of the lands that have already been assembled for residential development purposes would be affected and their utility limited, thus rendering it more difficult to fulfill the growing need for housing in the Metropolitan area.

Other

Other social, economic and community activities would suffer under the impact of a fully expanded Malton.

Schools would be affected. In these rapidly growing areas young families predominate; numbers of children and numbers of schools increase in direct proportion. In 1968 some 10,000 students were attending 17 schools within the areas affected by noise. This number is still increasing, particularly in the area outside the zones now controlled.

To make all these schools usable, a great deal of money would have to be spent on soundproofing. For instance, in Etobicoke $600,000 was spent by December 1968, to soundproof only three schools. Soundproofing, however, does not insulate the school yards where children spend time each day in play.

An alternative approach is to relocate the affected schools, but this is an even more costly process and could also be the cause of even more social disruption and alienation among both students and their parents.

The new Malton campus of Humber College would also be affected, as would be libraries, churches and community centres. As with schools, soundproofing and/or relocating both bear large social and financial costs.

Etobicoke General Hospital, a brand new structure, would lie within the noise zone if Malton were expanded as proposed in the 1967 Master Plan.

Certain office buildings and retail operations would also be affected. Some industrial uses would be relatively affected.

CONCLUSIONS

The decision taken in 1968 to limit the expansion of Malton was based upon a fundamental concern for the social well-being of the people of Toronto. In devising and effecting zoning controls the Federal and Provincial Governments provided guides to community development. The commitment of both Governments to these policies is proven by the successful application of the controls which has resulted in a slow rate of growth in the areas designated, in sharp contrast to the dynamic growth in adjacent communities.

The level of disruption which would be caused by reverting to the 1967 Master Plan now far exceeds that which would have been occasioned by proceeding with the expansion in 1968. The sound reasons for rejecting full expansion in 1968 have been substantiated in the years that have followed.

Experience is demonstrating the validity of the Federal Government's decision to meet the increasing demand for air travel by developing an aviation plan for Southern Ontario including the new Toronto Airport.

APPENDIX 1

LAND USE COMPATIBILITY

TABLE 1

LAND USE COMPATIBILITY TABLE

NOISE SENSITIVITY ZONES	I	II	III	IV	V	VI
TYPE OF OCCUPANCY						
DETACHED AND SEMI-DETACHED DWELLINGS	yes	A	B	C	no	no
TOWNHOUSES AND MAISONETTES	yes	A	B	B	no	no
APARTMENTS	yes	yes	B	B	D	no
COMMERCIAL	yes	yes	yes	F	F	G
HOTEL, MOTEL	yes	yes	F	F	F	G
OFFICE BUILDINGS	yes	yes	yes	F	no	no
SCHOOLS, HOSPITALS, LIBRARIES, CHURCHES & COMMUNITY CENTRES	E	F	F	no	no	no
THEATERS, AUDITORIUMS	E	G	G	G	G	no
OUTDOOR AMPHI-THEATERS	H	no	no	no	no	no
OUTDOOR RECREATIONAL	yes	yes	yes	yes	yes	yes
INDUSTRIAL & ANCILLARY USES	yes	yes	yes	F	F	G

EXPLANATORY NOTES

It is strongly recommended that all new residential development be avoided in zones IV, V, and VI. Accordingly, wherever possible alternative land uses should be considered.

It is important to understand that the locations of the lines between noise zones cannot be fixed exactly. It will be necessary in some specific cases therefore, for the responsible public authority to make an appropriate interpretation of what regulations are to be made applicable.

A. This is a marginal zone and noise may start to become a problem. It is recommended that developers be made aware of this fact and that they be required to so inform prospective tenants or purchasers of residential units. In addition, it is suggested that development should not proceed until an analysis of the noise environment is made and it is established what noise control features, if any, should be included in the building design.

B. The developer should be made aware of the noise problem and he must undertake to relay this information to all prospective tenants or purchasers of residential units. Moreover, construction may not occur unless a detailed analysis of noise reduction requirements for the specific development in question is made and needed noise control features are included in the building design.

C. These uses should not locate in this zone. Detached and semi-detached dwellings may be permitted as infilling but only as part of plans of subdivision, which, prior to the date of this statement being issued, have received draft approval. If development is to occur it is subject to the requirements of Note B.

D. No apartments should be constructed in this zone. Where it can be demonstrated that the proposed development constitutes a limited amount of infilling, however, development may be permitted but subject to the requirements of Note B.

E. It is advisable that these kinds of uses not be located close to the boundary between Zone I and Zone II but if they are it is strongly recommended that they be subject to the conditions of Note F.

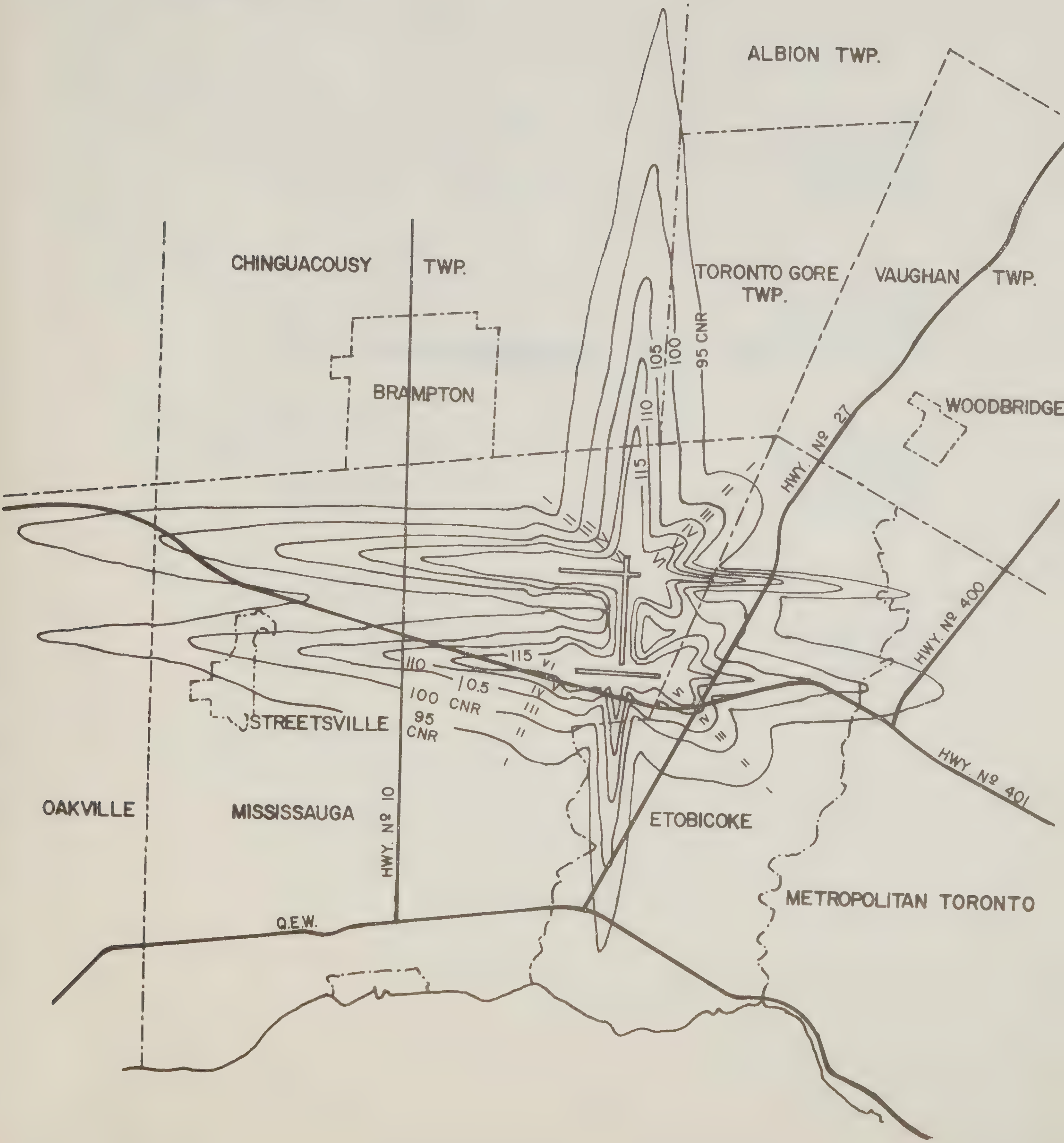
F. This construction may not occur unless a detailed analysis of noise reduction requirements for the specific development in question is made and needed noise control features are included in the building design.

G. None of these uses should be constructed in this zone. Where it can be demonstrated, however, that these uses are the most appropriate ones in specific cases, taking into account all relevant factors, construction may not occur unless a detailed analysis of noise reduction requirements for the specific development in question is made and needed noise control features are included in the building design.

H. This type of use should not be located close to the boundary between Zone I and Zone II.

NOISE SENSITIVITY ZONES 1975—1976

TORONTO INTERNATIONAL AIRPORT



APPENDIX 2

NEW ASSESSMENTS : 1969 - 1971

NEW ASSESSMENTS

1969

Town of Brampton	
Total Number of New Items	299
Total New Assessment	$2,955,790
Residential - Farm	1,299,115
Commercial - Industrial	1,656,675
Township of Chinguacousy	
Total Number of New Items	922
Total New Assessment	$15,456,700
Residential - Farm	12,634,920
Commercial - Industrial	2,821,780
Town of Mississauga	
Total Number of New Items	2,519
Total New Assessment	$21,288,110
Residential - Farm	14,196,530
Commercial - Industrial	7,031,580
Town of Port Credit	
Total Number of New Items	66
Total New Assessment	$ 2,934,690
Residential - Farm	2,395,560
Commercial - Industrial	539,130
Town of Streetsville	
Total Number of New Items	34
Total New Assessment	$ 1,175,400
Residential - Farm	1,152,640
Commercial - Industrial	22,760

NEW ASSESSMENTS

1970

Town of Brampton	
Total Number of New Items	175
Total New Assessment	$2,092,120
Residential - Farm	797,470
Commercial - Industrial	1,294,650
Township of Chinguacousy	
Total Number of New Items	177
Total New Assessment	$17,484,900
Residential - Farm	2,960,550
Commercial - Industrial	14,524,350
Town of Mississauga	
Total Number of New Items	2,198
Total New Assessment	$92,063,895
Residential - Farm	53,105,580
Commercial - Industrial	38,958,315
Town of Port Credit	
Total Number of New Items	28
Total New Assessment	$ 1,728,545
Residential - Farm	1,546,900
Commercial - Industrial	181,645
Town of Streetville	
Total Number of New Items	44
Total New Assessment	$ 1,443,785
Residential - Farm	1,034,560
Commercial - Industrial	409,225

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NEW ASSESSMENTS

1971

Town of Brampton	
Total Number of New Items	581
Total New Assessment	$13,458,400
Residential - Farm	10,716,280
Commercial - Industrial	2,742,120
Township of Chinguacousy	
Total Number of New Items	118
Total New Assessment	13,825,556
Residential - Farm	2,708,885
Commercial - Industrial	11,116,675
Town of Mississauga	
Total Number of New Items	1,296
Total New Assessment	$48,243,965
Residential - Farm	23,989,145
Commercial - Industrial	24,254,820
Town of Port Credit	
Total Number of New Items	38
Total New Assessment	$ 2,826,510
Residential - Farm	2,465,050
Commercial - Industrial	361,460
Town of Streetsville	
Total Number of New Items	89
Total New Assessment	$ 1,810,350
Residential - Farm	1,792,800
Commercial - Industrial	17,550

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Government Publications

TLINES

TORONTO -- Maps comparing the concentrations of population around Toronto International Airport and the site of the new Toronto airport at Pickering were released today. Prepared by the Toronto Area Airports Project team for the federal Ministry of Transport, the maps are based on newly-released 1971 census figures. These show that 38,000 people already live within what is called the 100 CNR (composite noise rating) contour at Malton. Outside the 100 CNR there are only isolated instances of noise annoyance, while inside the 100 CNR the noise annoyance becomes more severe as the runway is approached. If Malton had been expanded, as would have been necessary were the Pickering site not being developed, a fourth runway would have been necessary there. The 1971 census figures show an additional 56,000 people now living around Malton who would be adversely affected by noise, bringing the total to 94,000. By comparison, at Pickering there are approximately 2,500 people living on the site and approximately 2,500 living within the 100 CNR contour, bringing the total people to be affected by the development to 5,000. The Pickering map shows four representative runways; however, only two will be built in the first phase. The third runway, which the contours are drawn to include, may not be necessary until after 1990, and the fourth runway not until after the year 2000.

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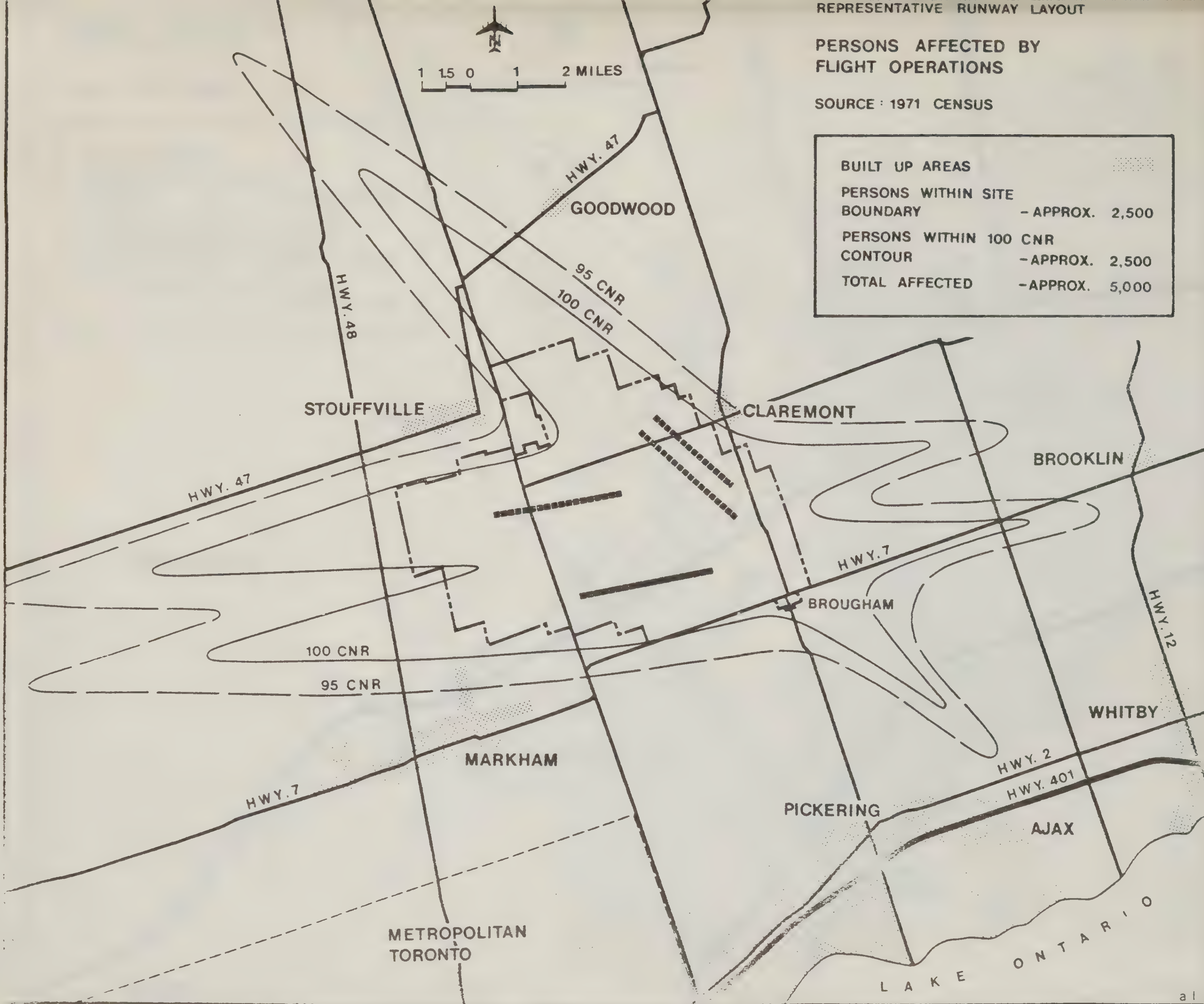
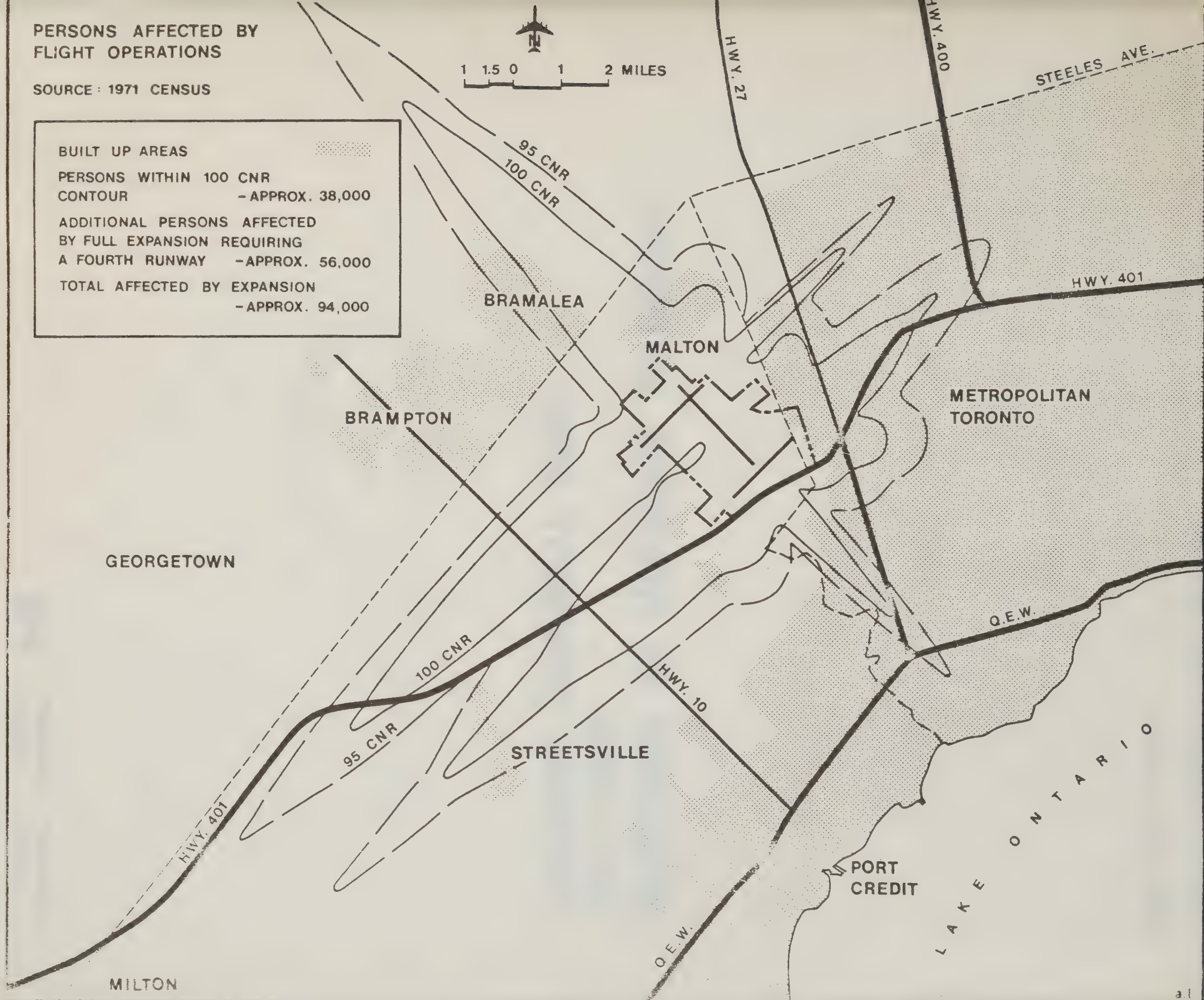
For further inquiries
contact Tim Porter,
Public Affairs Officer,
Toronto Area Airports Project.
369-4919


REPRESENTATIVE RUNWAY LAYOUT
PERSONS AFFECTED BY
FLIGHT OPERATIONS
SOURCE : 1971 CENSUS
BUILT UP AREAS
PERSONS WITHIN SITE
BOUNDARY -APPROX. 2,500
PERSONS WITHIN 100 CNR
CONTOUR -APPROX. 2,500
TOTAL AFFECTED -APPROX. 5,000
1 1.5 0 1 2 MILES
GOODWOOD
HWY. 47
HWY. 48
95 CNR
100 CNR
STOUFFVILLE
CLAREMONT
BROOKLIN
HWY. 7
BROUGHAM
HWY. 12
100 CNR
95 CNR
WHITBY
MARKHAM
HWY. 2
HWY. 401
PICKERING
AJAX
HWY. 7
METROPOLITAN
TORONTO
LAKE ONTARIO


PERSONS AFFECTED BY
FLIGHT OPERATIONS
SOURCE : 1971 CENSUS
1 1.5 0 1 2 MILES
BUILT UP AREAS
PERSONS WITHIN 100 CNR CONTOUR -APPROX. 38,000
ADDITIONAL PERSONS AFFECTED BY FULL EXPANSION REQUIRING A FOURTH RUNWAY -APPROX. 56,000
TOTAL AFFECTED BY EXPANSION -APPROX. 94,000
95 CNR
100 CNR
HWY. 27
HWY. 400
STEELES AVE.
HWY. 401
BRAMALEA
MALTON
BRAMPTON
METROPOLITAN
TORONTO
GEORGETOWN
Q.E.W.
100 CNR
95 CNR
HWY. 10
STREETSVILLE
HWY. 401
PORT
CREDIT
LAKE ONTARIO
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Toronto Area Airports System

June 29, 1972

GENERAL AVIATION IN TORONTO AND THE NEW TORONTO AIRPORT

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GENERAL AVIATION IN TORONTO

Civil aircraft in Canada can be divided into various categories including air carrier, military, corporate and general aviation. General aviation refers to all flying activities conducted by flying training organizations, to private, business and recreational flying and to charter flying by commercial air carriers using aircraft generally under 12,500 lbs. General aviation does not include the larger air carrier scheduled operations or training activities, private charter or corporate flying with large, high performance turbo-prop or turbo-jet aircraft operating frequently in accordance with instrument flight rules (IFR).

The number of civil aircraft in Canada has more than doubled over the past decade. In 1960 there were just over 5,300 aircraft registered and by 1971 the number had risen to over 12,000. General aviation aircraft make up the majority of the total including military were air carrier or government owned.

The general aviation fleet in the Toronto area is quite diverse, ranging from numerous small private aircraft operating solely under visual conditions up to sophisticated, turbo-jet aircraft which are as well equipped with flight instruments and sometimes even superior than conventional airline aircraft. Approximately 1000 aircraft are based at the various airports in the Toronto area.

General aviation facilities in the Toronto area are well developed to accommodate the flying activity. Within 50 miles of the vicinity of Toronto International and the new Toronto airport, there are at least 63 airports. This includes fully equipped airports such as that at Buttonville and privately owned grass strips adjacent to farmers' buildings.

An indication of the role played by Toronto International Airport in general aviation activity in the Toronto area is given in the following table which shows the number of aircraft movements in 1971 at several of the major general aviation airports in the Toronto area in comparison with the estimate for Toronto International. As Toronto International Airport is primarily an air carrier airport the majority of the movements are associated with the flying activities of the airlines, comprised of both itinerant (scheduled and charter) and local movements. In the past, the general aviation activity at Malton has been measured by the level of other itinerant movements, comprised of other non-airline commercial and private activities.

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In 1971, the total activity at the six general aviation airports was about sixteen times the estimated number of general aviation movements at Toronto International Airport.

		Estimated General Aviation Movements - 1971
Toronto International (other itinerant movements only)		54,082
Toronto Island	191,112	
Buttonville	185,182	
Oshawa	85,055	
Hamilton	206,319	
Waterloo-Wellington	87,431	
St. Catharines	79,357	
Total for six airports		834,456

Whenever the mixing of aircraft with widely divergent performance characteristics, i.e. light general aircraft with heavy air carrier aircraft, has threatened to lead to air traffic problems at, or in the vicinity of major airports, the Ministry of Transport has developed satellite airports to accommodate general aviation activity. For example, basic flying training, recreational flying, and other general aviation activities were gradually removed from Vancouver International Airport to Pitt Meadows, from Calgary International to Springbank, from Winnipeg International to St. Andrews, and from Montreal International to St. Hubert. In the Toronto area, private enterprise, municipal and other agencies have successfully provided excellent satellite airports and operated these on a commercially sound basis.

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To a steadily increasing degree, the intermingling of general aviation and airline activities in the Toronto area has required the introduction of control procedures, designated visual flight rule (VFR) routings, altitude restrictions and compulsory two-way radio. These measures will continue to be required and can be expanded if such action is required to take into account the effect of flight operations at the new airport on flights at Buttonville and Oshawa, as well as itinerant flights to and from these airports and through the area.

The new Toronto airport will be located some 25 miles northeast of the present Toronto International. Modification of the existing airway structure in the area will therefore be required and together with the adjustment of air traffic control procedures now in force will result in an effective and compatible operation.

Flight activities at Markham airport will have to cease when the new Toronto airport begins operation as this airport is within the expropriated area. The Ministry will work closely with the management of Markham airport to assist in the identification of a new location suitable for their operation.

Great care must be taken in the planning of the future use and protection of those airports considered essential to support the volumes of general aviation activity

in the years ahead. However, with the continued development of appropriate procedures and control methods and by effective and cooperative consultation with operations and representative pilot groups, both the airports and the airspace in the Toronto area can be organized into a completely coordinated air transportation system to safely meet the future needs of all users.

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ENQUIRIES

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PASSENGER AND CARGO FORECASTS

TORONTO AREA AIRPORTS PROJECT

BACKGROUND

On December 20th, 1968, the Minister of Transport announced that the Federal Government had decided against expansion of The Toronto International Airport at Malton to handle the total aviation needs of the Toronto area, that a second airport would be developed in the late 1970's, and that TIA Malton would continue in operation as an air carrier airport. In due course a conceptual plan for a multi-airport system was established. The Toronto Area Airports Team was formed to determine the requirements for the new facilities, to outline the roles of the airports in the system and to recommend an appropriate schedule for implementation.

For a major airport planning program, reliable forecasts of future traffic volumes are indispensable. They are used as an aid in determining the capacity of the facilities to be constructed and when these will be required. Forecasts of future passenger and cargo traffic at TIA were prepared in 1967 as part of the Master Plan for Toronto International Airport. Since the public announcement of the

new airport system plan in 1968, several additional traffic volume forecasts have been prepared using more recent information and more comprehensive techniques.

The purpose of this document is to review the passenger and cargo forecasting techniques that have been used by the Project Team and to summarize the results obtained.

FORECASTING TECHNIQUES

Comprehensive forecasting techniques were used in developing the estimates of future air passenger and cargo activity for the Toronto area. Extensive analyses were done of past actual activity data to establish preliminary growth rates of passenger and cargo traffic. These growth rates were then modified to reflect the anticipated effects of changes in socio-economic and other factors on the growth of air travel. Studies have shown that there is a relationship between economic and demographic indicators such as G.N.P., population, fare prices and disposable income and the demand for all modes of transportation, including air transportation.

Air cargo forecasting is particularly difficult. This market has been limited by the availability of suitable aircraft with adequate space and only now is being recognized as a distinct and important market. Thus both the demand for air cargo and availability of aircraft must be considered. For instance a mix of freighter aircraft plus the under floor compartment (belly) capacity on passenger aircraft is used to carry cargo. However, if the available

cargo proves to be too much for the belly space available, it may not be practical to use freighter aircraft and the demand may be satisfied by other modes of transportation.

This paper summarizes the methodologies used and the results obtained in the various forecasts used by the Team to date. Air passenger and cargo forecasts are presented separately. Forecasts are discussed in chronological order in each section. The last forecast prepared in both the passenger and cargo sections is presented in more detail in terms of the methodologies used. As well, a short summary is presented at the beginning of each section comparing the results of the various forecasts. It should be noted that all air passenger traffic figures are given in enplaning/deplaning except as otherwise noted.

PASSENGER FORECASTS FOR THE TORONTO AREA

Forecasts of passengers on the Toronto project were prepared to the year 2000 to cover the total planning period. This is consistent with the planning being done in all areas related to the development of the airport system. Within this planning time frame, one can be most specific about the forecasts up to the late 1980's, which coincides with the initial and intermediate development period for the new airport.

For this period historic data is generally reliable as a base and there is sufficient knowledge about future developments to permit realistic forecasts. These forecasts show that the new facility will be required for the 1980's, otherwise the needs of the travelling public in the Toronto area will not be adequately served. For the latter part of the planning period, up to 2000, the forecasts are based more on the informed judgements of the forecasters as to the probably growth of the economy and of air travel in terms of the trends in business and recreational travel, and the effects of new aircraft technology and high speed ground transport.

To cover expansion of the new airport beyond the 1980's, new forecasts are continually being prepared as more up-to-date information becomes available on the likely performance of the economy and the growth of air travel.

The analysis of Toronto passenger traffic in the 1960's, as recorded by the Aviation Statistics Centre, indicates the average annual growth shown in Table 1. The higher growth rates for international passengers, both charter and scheduled, reflect the dramatic growth in recreational travel during the decade, attributable to a great extent to the increase in leisure time, the decline in air fare prices and the increase in personal disposable income.

AVERAGE ANNUAL GROWTH RATE IN TORONTO PASSENGER TRAFFIC (1960 - 1970)*

OVERALL AVERAGE GROWTH	13.7%
BY PASSENGER SECTOR:	
Scheduled flights with Canadian points	10.0%
Scheduled flights with United States points	13.0%
Scheduled flights with other international points	17.8%
Charter flights	39.3%

* See subsequent section Table 7 et al.

Modification of these growth rates to take into account the anticipated effects of changes in socio-economic and other factors resulted in a set of future growth rates. This analysis led to the conclusion that the relatively high growth rates for air passenger traffic in the Toronto area during the 1960's would not continue over the next twenty or thirty years. Rather the rate of growth in air travel will decline to approximately the long-term forecast growth rate for the Canadian economy; that is, about 5 per cent per year in real terms. Table 2 outlines the long term air passenger growth factors used in the Toronto forecasts and shows the decline in the annual growth rates in each of the passenger flight sectors. The higher growth rate in the charter

Table 2

FORECAST ANNUAL AIR PASSENGER GROWTH RATES TO 2000

FOR TORONTO

	Passenger Flight Sector				
	Scheduled Flights with Canadian Cities	Scheduled Flights With American Cities	Scheduled Flights With International Cities	Charter Flights	Average Growth
Actual 1960's	10.0%	13.8%	17.8%	39.3%	13.7%
1971-75	7.5%	10.2%	11.7%	20.0%	10.5%
1976-80	6.5%	8.8%	10.0%	15.0%	9.3%
1981-85	6.1%	7.1%	8.1%	12.0%	8.0%
1986-90	5.7%	6.1%	6.4%	10.0%	7.1%
1991-95	5.3%	5.3%	5.3%	10.0%	6.7%
1996-2000	5.0%	5.0%	5.0%	10.0%	6.4%

segment reflects the continuing higher growth of recreational air travel over the forecast time frame.

SUMMARY OF TORONTO PASSENGER FORECASTS

Four passenger forecasts have been used on the Toronto Airports Project. Table 3 following summarizes the results from these four studies. Figure 1 also outlines graphically the results of the January, 1972 forecast. The December, 1969 study does not include data for charter passengers at Toronto. Insufficient statistics on this segment were available at the time of its preparation to permit meaningful forecasts. The charter estimates in the last three forecasts are not separated from the totals as the nature of this market has been changing quite rapidly and is anticipated to change even further, so that identification of it as a separate total is not considered meaningful.

From the comparison of the four forecasts shown in Table 3, it can be seen that the updates of the original forecast using more recent actual information and more detailed techniques do not change the results substantially.

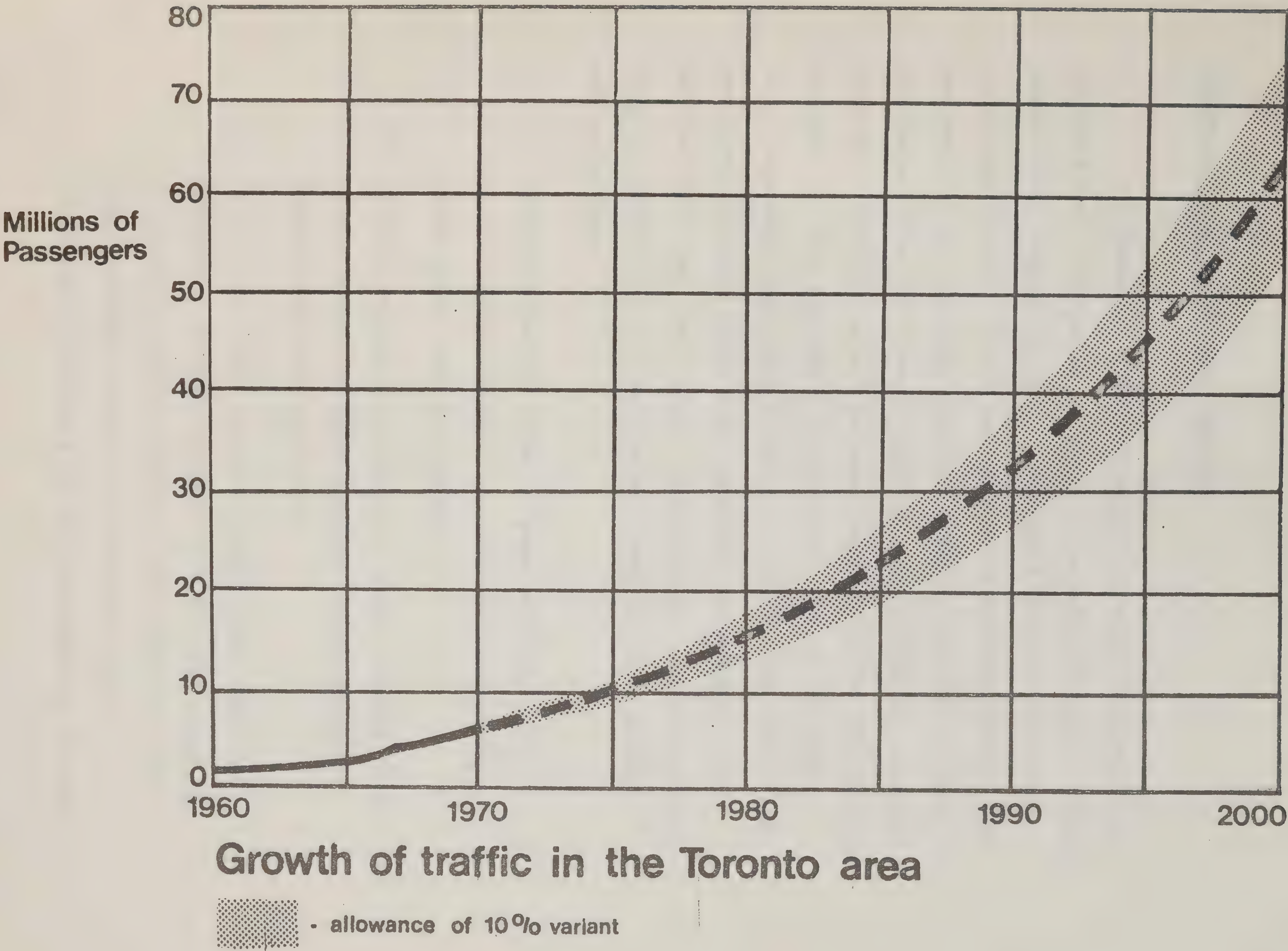
Table 3

TORONTO AIRPORTS PROJECT

SUMMARY OF ANNUAL TORONTO PASSENGER FORECASTS
(MILLIONS OF PASSENGERS)

Year	December, 1969 Forecast (No charter incl.)	September, 1970 Forecast	May, 1971 Forecast	January, 1972 Forecast
1970	5.3		6.3	6.3
1975	8.0		10.2	9.2
1980	11.7		15.5	15.9
1985	16.4	18.7	22.4	23.2
1990	21.6	28.6	31.1	32.5
1995			42.7	44.8
2000		66.4	58.5	61.9

FIGURE 1



Growth of traffic in the Toronto area

DECEMBER, 1969 PASSENGER FORECAST

In December, 1969, aviation activity forecasts were prepared for 26 airports in Canada, including Toronto. These projections, issued in 1969, were based on more up-to-date actual information (1967) and more detailed methodology than was used in the original forecast prepared in 1967 as part of the Master Plan for Toronto International Airport. Although this new forecast was not prepared especially for the Toronto project, it does provide a valid comparison to the three later forecasts made specifically for use by the Team. The passenger forecast dealt with scheduled passengers (air carrier) only, as insufficient data were available to provide input on charters. The methodology used in this forecast was as follows:

(a) Fitting straight lines to past activity data by the method of least squares and projecting these lines into the future.

(b) Fitting exponential curves to past activity data by the method of least squares and projecting these lines into the future.

(c) Predicting total Canadian traffic and the proportion of this traffic at each site based on an analysis of past trends. The prediction of total Canadian traffic was derived from a mathematical analysis of the relationship between

Canadian G.N.P. (in current dollars) in the past and the total number of Canadian boarding passengers.

(d) Analyzing past traffic growth by route and applying adjusted future growth rates based upon a detailed knowledge of the influence of service qualities, prices, communities of interest, degree of competition, etc., in the past and any predicted changes in the inter-related effect of these key determinants in the future.

The first two parts of the methodology set lower and upper limits to the forecast, but much more weight was attached to the third and fourth techniques. The final forecast was not an average of the results of the different forecast segments generated, but was based instead on judgements as to the probable relative accuracy of the statistical analysis and the route by route analysis techniques.

The results of this forecast are shown below.

TABLE 4

	DECEMBER, 1969 FORECAST OF ANNUAL SCHEDULED PASSENGERS AT TORONTO (MILLIONS)
1970	5.3
1975	8.0
1980	11.7
1985	16.4
1990	21.6

SEPTEMBER, 1970 PASSENGER FORECAST

A second forecast was prepared in September, 1970. The report dealt with the detailed evaluation of alternative sites for a second Toronto area airport and as part of the analysis, contained a revised passenger forecast which had been prepared on behalf of the Toronto Team in mid-1969 based on more current 1968 base-year data. In addition to forecasts of scheduled passenger activity, the report included the first formal forecast of charter traffic out of Toronto. The forecasting period in this report was extended to the year 2000.

The methodology used in developing this later forecast was basically similar to that used in the December, 1969 forecast, except that new forecasts were produced for individual routes. These new forecasts of passenger traffic by route by airline were prepared by estimating growth rates for each route and applying them to the new base data for 1968. From these revised route forecasts, totals for Canadian, United States and other international passengers were obtained by aggregating the results for the individual routes. Total passengers were then obtained by summing these three major flight categories.

In forecasting the charter traffic, attempts to correlate charter activity with established indicators such as G.N.P., income and population proved inconclusive. However, based on data for actual charter traffic obtained from the Canadian Transport Commission for 1962-1968, a forecast was developed using the following assumptions:

- 100 per cent of operations would be transocean
- seating capacity would increase at 5 per cent per year and passenger volume at 15 per cent per year.

The passenger forecast from this report is outlined below.

TABLE 5

	SEPTEMBER, 1970 FORECAST OF ANNUAL PASSENGERS AT TORONTO (MILLIONS)
1985	18.7
1990	28.6
2000	66.4

The forecasts for 1990 and 2000 are a middle point between pessimistic and optimistic forecasts prepared for those years.

MAY, 1971 PASSENGER FORECAST

The purpose of this study reported in May, 1971, was to present a revised set of forecasts, based on later actual activity information (1969), with the data base and methodology clearly defined so that any modifications or extensions which might become necessary as the project proceeded could be made in a logical and consistent way.

The study was not concerned directly with the preparation of basic forecasts, but rather took the basic forecasts prepared in the first two studies described above and developed from them revised detailed forecasts. The new forecast time framewas to 2000 and included both scheduled and charter air carrier activity.

Scheduled passenger activity forecasts were generated using the following procedure:

(a) The forecasts were based on 1969 Airport Activity Statistics compiled by the Aviation Statistics Centre. Forecasts from this base were made using as a guide the first forecast outlined above.

(b) Growth rates for total traffic and for the Canadian, American and other international segments were extracted from the previous

forecasts by plotting the forecasts of passenger boardings to 1990, extrapolating to 2000, and taking average annual growth rates for five-year periods from 1970 - 2000.

(c) The different growth rates for short, medium and long distance traffic within each segment were obtained using as a guide the forecasts by route described in the September, 1970 forecast, and the same graphical technique as in (b).

(d) Growth rates were discussed with the airlines and adjusted where considered necessary.

(e) Growth rates were translated into revised passenger volumes using 1969 actual base-year data.

The original charter traffic forecast in the September, 1970 study called for 289,000 passengers at Toronto in 1970. In fact, the actual volume in that year was in the order of 450,000 passengers. A new forecast was therefore prepared as part of this third study. A new base figure for 1969 was derived by assuming that transocean traffic would only be 80 per cent of the total. Growth rates were obtained from an examination of past data and an estimate of the

probable effect of the policies of the scheduled carriers on the future growth of the charter market. From actual growth rates for charter passengers of 36 per cent per year between 1962 and 1970 but only 20 per cent from 1969 to 1970 it was estimated that growth for 1970 to 1975 would be 20 per cent, and would drop off gradually thereafter.

The following table summarizes the results from this study:

TABLE 6

	MAY, 1971 FORECAST OF ANNUAL PASSENGERS AT TORONTO (MILLIONS)
1970	6.3
1975	10.2
1980	15.5
1985	22.4
1990	31.1
1995	42.7
2000	58.5

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[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
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[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

JANUARY 1972 PASSENGER FORECAST

In January, 1972, a revised passenger forecast was issued by the Project Team which was the result of two additional pieces of research:

1. A comprehensive analytical work program carried out to assess the validity of the previous May, 1971 passenger forecast.

2. Revised factors developed for converting origin/destination passengers to total enplaning/deplaning passengers at Toronto.(1)

The remainder of this section on the January, 1972 forecast outlines the methodologies used in the two parts of the work program.

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(1)

Origin/destination refers to the number of passengers who start/finish their total journey at Toronto. Enplaning/deplaning is the total of the origin/destination passengers plus those passengers connecting to other flights at Toronto. Both measures are used in planning airport facilities. For example, origin/destination activity would provide a measure of the load on the ground transportation facilities.

Enplaning/deplaning which is the higher figure, provides a measure of the total load on the terminal building itself. In the four passenger forecasts discussed in this paper, the enplaning/deplaning values have been shown as they more accurately outline the need for new facilities.

Assessment of Validity

To assess the validity of the previous May, 1971 passenger forecast, the following methodology was used:

1. Regression analysis was carried out to establish the average passenger growth rate at Toronto for the 1960's in several major passenger categories (domestic short-haul, international, etc), and for selected city pairs which comprise significant fractions of the total traffic within their own category.

2. From the results of the regression analysis, growth trends up to the year 2000 were projected which were then applied to 1970 actual figures to provide a new independent volume forecast.

3. The results of this analysis were compared to the May, 1971 forecast to assess the validity of this forecast.

The regression analysis was aimed at establishing the average growth rates of the 1960's. If the growth rates resulting from the regression are applied to the base year figures for the various passenger categories by compounding, the method will yield a good approximation of every year's passenger volume in the regression period. Using this method an exponential curve was fitted to each series of data. The regression equation used in fitting this curve is given by:

$$Y = Ae^{Bt}$$

Where: Y = the estimated number of passengers for a given year.

A = the estimated initial traffic volume in the first year in the regression period.

e = the base of natural logarithms

B = corresponds to the estimated annual increase in volume

t = the sequence number of the year in the regression.

The results of the regression analysis in terms of average annual growth rates for the various major flight categories are shown in Table 7. The results of the analysis gave excellent correlation with the regression correlation coefficient (R^2) being above 0.95 in all series.

TABLE 7

PASSENGER SECTOR	AVERAGE ANNUAL GROWTH RATES IN TORONTO PASSENGER TRAFFIC IN THE 1960's
Scheduled flights to Canadian points - short (less than 500 miles)	8.1%
- long (500 miles and over)	13.7%
- overall	10.0%
Scheduled flights with United States points	
- short (less than 500 miles)	12.5%
- long (500 miles and over)	19.4%
- overall	13.0%

Flights with other international points	
- scheduled	17.8%
- charter	39.3%
- overall	24.7%
Overall average growth rate	13.7%

These results refer to the time periods of 1960 to 1970 for Canadian points, 1962 to 1970 for United States points and 1963 to 1970 for other international points.

In projecting the growth trends up to the year 2000, the Project Team did not assume that the high growth rates of the 1960's would continue without slowdown or interruption for the next 30 years. Such an assumption would have lead, for example, to an absurd 690 million international passengers alone at Toronto by the year 2000. A gradual reduction in the growth rates is anticipated over the next few years so that in the long-term the annual growth rates will approximate the long-term expectations of the G.N.P. The process involved in producing these forecast growth rates was based to a considerable extent on the informed judgements of the forecasters as to the probable growth of the economy and the corresponding growth in air travel as there is no scientific way to predict with absolute certainty the socio-economic environment and technologies which will precisely define the volume and distribution of air traffic beyond the 1980's.

The forecast growth rates were based on the following assumptions:

1. The long-term growth of the Gross National Product will be 5 per cent per annum in real terms.

2. There will be a trend towards higher disposable incomes, longer vacations and an increased propensity for personal non-business travel.

3. There will be no radical change in aircraft technology beyond STOL and SST and that improved ground transportation as now being developed will affect a larger share of the short haul business market particularly Toronto-Montreal.

The results of this new independent forecast were then compared to the previous forecast of May, 1971. The differences in the two estimates were not at all significant with the passenger volumes in the critical early and late stages of the forecasting period being very similar. It was therefore concluded that on the basis of this independent forecast there was no reason for radically changing either the growth rates or volume forecasts.

Revised Conversion Factors

In the second part of the work program for developing the January, 1972 forecast, data was obtained from the Aviation Statistics Centre which permitted a more up-to-date analysis of the number of passengers originating at points away from Toronto who either came to Toronto as a destination or passed through Toronto to connect with other flights on their way to other destinations. From this analysis, the Project

Team was able to develop, for each passenger category, the percentage of passengers connecting through Toronto as a percentage of the total number of passengers originating or terminating their journey in Toronto. The results produced the following revised factors for converting origin/destination passengers to enplaning/deplaning for the Toronto area.

TABLE 8

PASSENGER CONVERSION FACTORS FOR TORONTO - ORIGIN/DESTINATION TO ENPLANING/DEPLANING

Scheduled flights with Canadian points - short haul	1.44
- long haul	1.51
Scheduled flights with United States points	
- short haul	1.20
- long haul	1.22
Scheduled and charter flights with other international points	1.20

Results of January, 1972 Forecast

These revised conversion factors were applied to the origin/destination portion of the May, 1971 forecast, which had been validated in the first part of the work program in preparing this new forecast. The following revised set of passenger forecasts to the year 2000 resulted.

	JANUARY, 1972 FORECAST OF ANNUAL PASSENGERS AT TORONTO (MILLIONS)
1970	6.3
1975	9.2
1980	15.9
1985	23.2
1990	32.5
1995	44.8
2000	61.9

AIR CARGO FORECASTS FOR THE TORONTO AREA

Several forecasts of air cargo activity have been developed for the Toronto region. Four of the more recent forecasts have been used by the Toronto Area Airports Project Team. The first three basically revolved around projected historic growth rates to 1990. The most recent (January, 1972) forecast evolved from a rationale considering economic influences, inherent costs and time parameters as well as airline capability to meet these demands. It demonstrated that the assumptions used in producing the first three cargo forecasts led to optimistic results. Although this last forecast resulted in substantially lower relative estimates, total growth over the period is estimated to be almost fifteen times the current volume.

NATURE OF AIR CARGO FORECASTS

The basic relationships which govern the growth of air cargo have been difficult to determine. Air cargo is an infant industry. As such, no well-established trend as to its relative share of the intercity goods movements market has been observed. Further, present airline indications suggest that capacity to meet the demands for air cargo in terms of all-freighter aircraft will be suppressed. Nevertheless sufficient information is available to allow a reasonably definitive statement of forecast requirements.

SUMMARY OF CARGO FORECASTS

The four air cargo forecasts for the Toronto region which are significant in terms of the Toronto Area Airports Project are summarized in Table 10, following. Figure 2 also outlines graphically the results of the January, 1972 forecast.

As can be seen from the table the first three forecasts show essentially similar results for the year indicated, while the most recent forecast indicates relatively lower results, particularly in the later years.

DECEMBER, 1969 AIR CARGO FORECAST

In 1969, the Canadian Department of Transport released the results of a study of air cargo forecasts at twenty-six airports across Canada including Toronto. In the study the total pounds to be handled up to 1990 at each terminal was forecast. Although no detailed description of the technique was provided, it appears that the historic growth in air cargo was analyzed by statistical techniques and the resulting trends were projected to give future volume estimates, taking into consideration the anticipated effects of regional characteristics, G.N.P., population changes and disposable income. The results of this analysis are as follows:

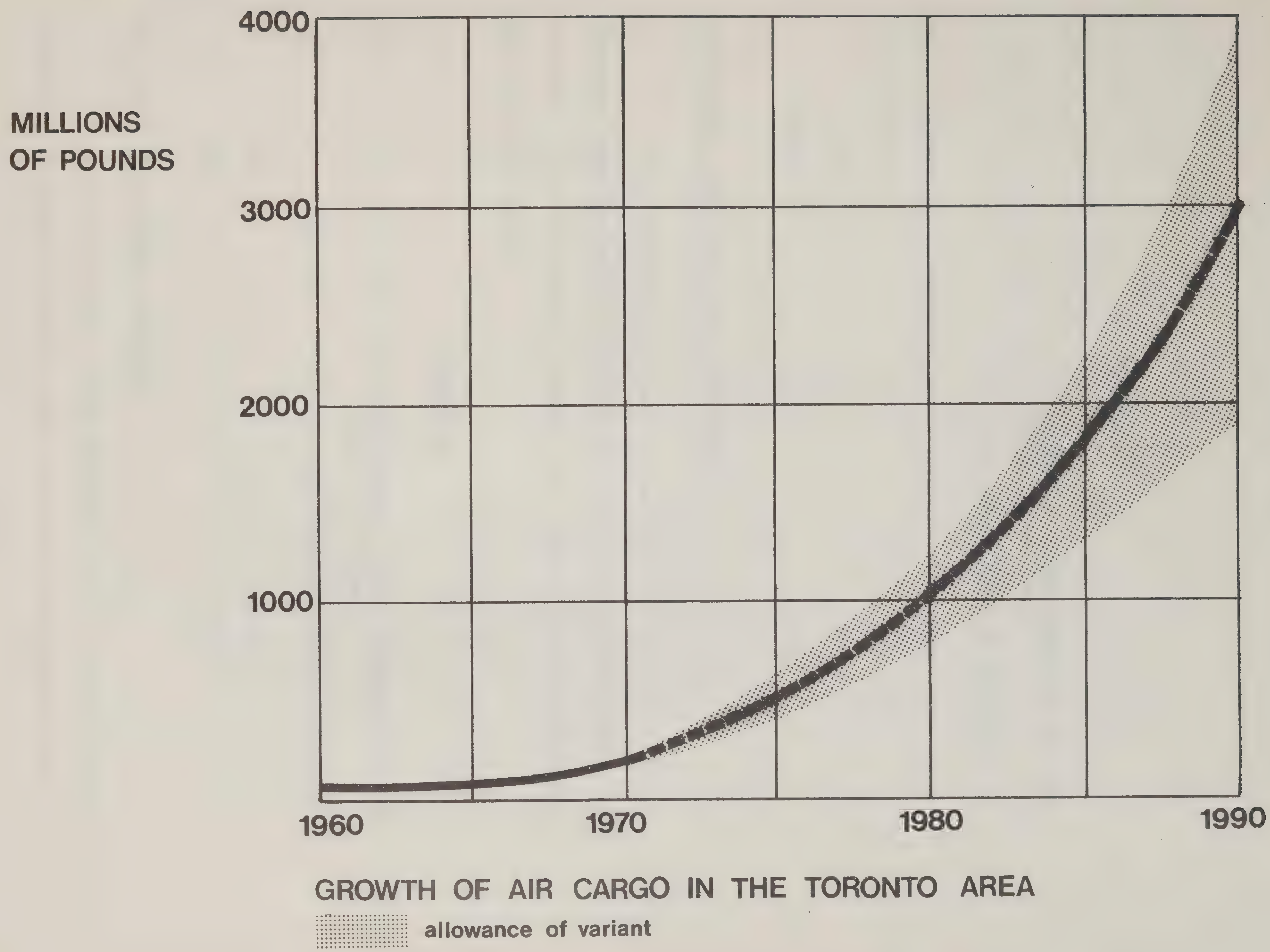
Table 10

TORONTO AREA AIRPORTS PROJECT

SUMMARY OF ANNUAL TORONTO CARGO FORECASTS
(MILLIONS OF POUNDS)

Year	December, 1969 Forecast	September, 1970 Forecast	May, 1971 Forecast	January, 1972 Forecast
1970	198	-	227	224
1975	441	-	508	492
1980	1,005	-	1,155	999
1985	-	2,100	2,456	1,868
1990	4,600	4,800	5,260	3,089

Figure 2.



GROWTH OF AIR CARGO IN THE TORONTO AREA

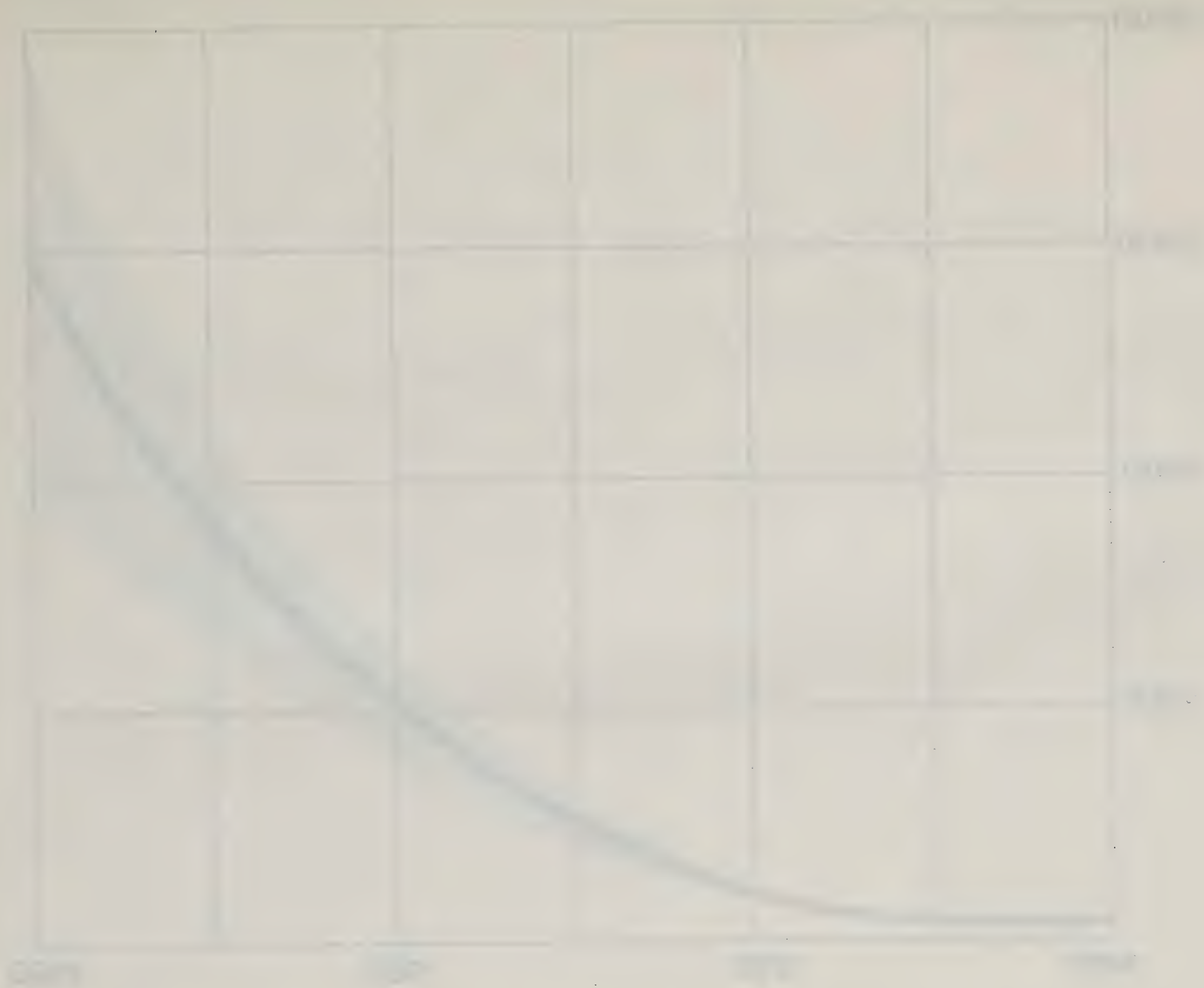


TABLE II

	DECEMBER, 1969 FORECAST OF AIR CARGO AT TORONTO (MILLIONS OF POUNDS)
1970	198
1975	441
1980	1,005
1990	4,600

SEPTEMBER, 1970 AIR CARGO FORECAST

The methodology used in developing this air cargo forecast was basically similar to that used in developing the December, 1969 estimate, except that the new base year data for 1968 was used.

TABLE 12

	SEPTEMBER, 1970 FORECAST OF AIR CARGO AT TORONTO (MILLIONS OF POUNDS)
1985	2,100
1990	4,800

MAY, 1971 AIR CARGO FORECAST

This third air cargo forecast was an update of the previous forecasts based on more current (1970) actual air

cargo data. In preparing this forecast, no new rationale was developed, rather the estimate was produced by applying the growth rates established in the December, 1969 forecast to the new base year data. The results of this analysis produced data quite similar in magnitude to those from the previous two forecasts.

TABLE 13

	MAY, 1971 FORECAST OF AIR CARGO AT TORONTO (MILLIONS OF POUNDS)
1970	227
1975	508
1980	1,155
1985	2,456
1990	5,260

JANUARY, 1972 AIR CARGO FORECAST

The objective of this study was to develop a strong rationale for air cargo forecasting. This was developed into a forecasting framework which would be used to verify or disprove the previous estimate.

This study presented, through a highly detailed analysis, a completely revised set of air cargo forecasts. These forecasts structed into mathematical form much of the practical knowledge concerning the air cargo field. Specifically, the technique accounted for the following:

1. The relationship of the total Canadian air cargo market to the Gross National Product
2. The relative changing economic position of the Toronto region with respect to the rest of the country.
3. The anticipated cost changes of air cargo production.

Three regression models were used to develop air cargo forecast control totals. These control totals were then adjusted to final air cargo volume forecasts by taking into account the following factors:

1. Anticipated changes in regional economies in Canada. This would affect total volumes between Toronto and these regions.
2. Anticipated changes in directional volumes to and from several specified points. These were analyzed considering airline forecasts of improving directional volumes.
3. Anticipated lack of supply on specific routes, particularly lack of air freighter availability on routes of less than 500 miles.

The three models used in developing the forecast control totals were:

1. A national model relating dollars of G.N.P. to pounds of cargo handled at the 25 largest airports in Canada.
2. A Toronto share model which defines the proportion handled at Toronto of the National pounds, developed in the previous model.

3. A Regional model relating dollars of G.N.P. to domestic pounds handled at Toronto. This model was developed separately as a check on the validity of the Toronto control forecast developed from the first two models. It considered economic activity in the Toronto region only without reference to the National model.

In using these regression models, exponential curves were fitted to each series of data. The regression equations for each of the models is given by:

1. National Model

$$Y = ae^{bx} + c$$

where: y = \$ G.N.P./National pounds handled

x = the sequence number of the year from 1960 in the regression

e = the base of natural logarithms

a = defines the level of air cargo activity growth above natural growth in 1960

b = defines the manner in which the rate of growth will occur on a yearly basis for the forecast period. It is directly related to the changing air cargo technology, including changes in air cargo production costs.

c = defines the natural growth rate of air cargo in relation to Canada's total cargo activity. The growth rate in air cargo will eventually become asymptotic to this value.

2. Toronto share model

$$y = A - ce^{bx}$$

where: y = the proportion of national pounds handled at Toronto.

x = the sequence number of the year from 1960 in the regression

e = the base of natural logarithms

A = represents the maximum level of air cargo activity for the Toronto region as a share of the national total.

b = defines the manner in which the percentage of air cargo activity in the Toronto region will increase in relation to the national air cargo activity. It reflects the growing economic impact of Toronto on the national scene.

c = the original percentage of the national total in year zero in the regression.

3. Regional Model

$$Y = Ae^{bx} + c$$

where: y = \$ G.N.P./domestic pounds of cargo handled at Toronto

x = the sequence number of the year from 1963 in the regression

e = the base of natural logarithms

A,B,C, = the definition for these factors is the same as in the national model, except substitute regional for national, where applicable.

The results of the regression analyses show excellent fits, with the regression correlation co-efficients (R^2) above 0.98 in all cases.

RESULTS OF THE FORECASTS

The application of the models to forecast the growth in cargo as related to G.N.P. showed that air cargo in 1980 will reach its full share of the total cargo market. After that time, its growth will approximate the growth in the total cargo market (all modes), which in turn will approximate the growth of the G.N.P. in real terms.

On the other hand, the economic position of Toronto with respect to the rest of the country shows continued faster growth, so it is logical to predict that air cargo at Toronto will grow more rapidly than the national volume. The results of the analysis indicate that Toronto should increase from its present 29 per cent share of the national air cargo market to about 32 to 34 percent within the next 15 years and will stabilize at that level.

The results of the most recent air cargo forecast are shown in the following table:

	JANUARY, 1972 FORECAST OF AIR CARGO AT TORONTO (MILLIONS OF POUNDS)
1970	224
1975	492
1980	999
1985	1,868
1990	3,089

CONCLUSION

The conservative approach taken in preparing these forecasts is based on the assumption that new technological developments in competitive modes of transportation and communications will absorb some of the potential growth for air travel. As the air travel industry matures it will cease to enjoy the disproportionate growth of the 1960's and will gradually decrease until it generally conforms with the real increase in the Gross National Product. Notwithstanding this conservative approach, the growth of passenger traffic in the Toronto area is forecast to grow by a factor of 8 while cargo volumes will increase by 15 times today's level. These figures demonstrate conclusively that Toronto needs the additional facilities which will be provided by the new Toronto Airport.

Forecasting is a dynamic process with revised figures being produced as new information becomes available. As the date of opening of the new airport approaches these more precise figures will guide us in determining the traffic to be allocated to the new airport and Malton and the extent and size of the facilities at the new airport.

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Toronto Area Airports System

June 30, 1972

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PEOPLE AND THE NEW
TORONTO AIRPORT

By 1966, when the Minister of Transport commissioned a detailed study of the long-range increases in air traffic in the Toronto region, the pattern of growth was already clearly emerging. The large, long range jet-engined aircraft introduced into service in the early sixties had made long-distance travel possible at a speed and price not contemplated in earlier decades. Declining fares, longer holidays and increasing affluence were beginning to result in the opportunities of air travel being extended to the many. Every year more and more people fly long distances to visit friends and relatives or to take a holiday in Europe, the Caribbean, or even Asia. Additional numbers fly to visit relatives and other places in Canada. The steady growth of the short-haul business traffic has thus been boosted by the burgeoning of long-haul flights made for social contact and recreation. These long-haul flights are expected to comprise the more rapidly growing and major part of the air passenger market in the years to come.

The 1967 Master Plan for Malton, which was announced in 1968, showed that this airport could only be expanded to meet these growing needs at the expense of causing social disruption to large numbers of people who were not being affected by the existing operations at Malton. From this the Government of Canada concluded that the precondition of expansion at Malton related to land use compatibility could not be satisfied, and decided against the full-scale expansion

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of Malton. This decision, taken in December 1968, received widespread public support.

Simultaneously with the decision to limit Malton, a joint federal-provincial committee was established to develop a comprehensive aviation plan for Southern Ontario, and to study alternative sites for a second major airport for the Toronto area. The new aviation plan was devised to meet the requirements of fast growing air traffic markets, especially long haul, while reducing to a minimum the number of people who would be adversely affected by such growth.

This paper describes how this end will be achieved by the use of Malton and the new Toronto airport. The social and economic need to expand airport facilities will be satisfied while the number who will be affected by flight operations at the new airport will be a fraction of those who would be disrupted if all traffic had to be handled at Malton. Those persons who are displaced by airport construction will receive fair treatment from the Federal Government, to ensure that the benefits to the majority are not obtained at the expense of a few. The new Toronto airport will also bring a new and wider range of jobs to the eastern part of the Toronto-Centred Region, and provide strong support for Ontario's plans to develop forward-looking new communities aimed at establishing new standards in the quality of urban life.

The Social Cost at Malton

What was the social cost at Malton that led the Government of Canada to conclude that the full expansion should not go ahead? Every analysis of air traffic made for the Toronto region has indicated that there will be continuing rapid growth of demand both in passengers and in freight in the Toronto area. Long-distance flights principally for purposes of holidays or social contact are increasing relatively more rapidly than others. Heavily-laden large aircraft taking off for distant destinations on hot summer days are the noisiest of all. This type of air traffic is at a peak at this time of year, when people are making maximum use of their gardens for outdoor living.

The 94,000 people living in the areas which would have been affected by the full-scale expansion of Malton have demonstrated that this land is highly desirable for housing. Much of the land not already occupied had been serviced and plans and investments relating to construction had been made. Were extensive land use controls introduced the lands in question would be sterilized, and this would have had wide implications in terms of dismembering planned communities already partly developed.

The Plan for Malton did, however, establish that the facilities at Malton could readily be expanded to accommodate the traffic of the 1970's within the existing airport boundary.

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This expansion could be achieved without increasing significantly the area affected by noise in that period of time, due to the increasing size of aircraft resulting in fewer flights, and the promise of quieter engines. An Interim Development Plan was therefore prepared to provide Malton with adequate capacity to the end of the 1970's; it did not affect prime residential land to nearly the same extent. The Federal and Provincial Governments established guidelines for land use. Controls based upon the guidelines were promulgated by the Provincial Government in October, 1969. Their acceptance has led to land usage compatible with the anticipated level of flight operations in the late 1970's.

To meet the projected air traffic demand of the 1980's and beyond, Malton's area would have to be enlarged so that new runways, terminals and other facilities could be constructed. In addition, the existing runways would be used far more heavily than at the present time causing even higher noise levels than anticipated in the established guidelines to those lands now affected, and causing disruption to others not now affected.

To ensure land use compatible with this expansion it would be necessary to introduce controls over a much wider area than those already in force. To subject such a large area of prime residential land to noise was regarded as unacceptable in 1968. Since that time substantial further

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construction of desirable homes has taken place in the areas involved. The disruption to people which would be caused by expanding Malton would now be even greater than when the original decision was taken. Many thousands who have moved into new houses in good faith relying on the announcements made in October 1969 would find themselves affected by flight operations in a way that the Provincial controls were designed to prevent.

To summarize, it has been calculated that if Malton were to be upgraded to provide the necessary level of services, the consequences would be as follows:

1) Approximately 94,000 people who now live in Etobicoke, North York, Bramalea and other areas - and who lived there prior to the introduction of zoning legislation by the Province - would be subjected indefinitely to unacceptable noise levels.

2) Because Malton is in such a central location there is continued pressure for new residential development within land affected by existing and potential noise. Unless extended controls were introduced over what is otherwise prime residential land and which is now unaffected, the number of residents who would be affected in the future would increase rapidly.

<u>The Social Benefit of the New Toronto Airport</u>

It is estimated that construction of the new airport at Pickering will disturb approximately four thousand five hundred people due to airport land needs and aircraft flight operations. Despite this, the overall effect on people is

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<u>much</u> <u>less</u> than if Malton were to continue to handle all of the traffic in the Toronto area, for the following reasons:

1. Although the character of the Pickering area is changing as is demonstrated by the fact that within the airport site less than 50% of the land is held by owner-farmers, there has been little actual residential development in the vicinity of the new airport. The Provincial Government has thus been able to introduce controls through zoning and other development control techniques, before the growing pressure had resulted in construction.

2. While at the new Toronto airport about 2,500 people will initially be relocated (over a period of several years and completely at government expense) only approximately another 2,000 people now reside on land which may ultimately be subject to a Composite Noise Rating (CNR) of higher than 100. This means that overall in Toronto there will be far fewer people affected by the consequences of flight operations if two major airports are in operation.

3. The Federal and Provincial Governments have, by working together, been able to integrate the planning of airport and region to ensure that future development will not be incompatible with flight operations. The residential areas of new communities near the airport, such as North Pickering, will lie between flight paths and will not be affected by noise. Land which may be affected by noise will be committed to industrial and agricultural use and will include the principal transportation and service corridors.

In terms of absolute numbers the new Toronto airport will only affect a fraction of those who would be subject to disturbance if Malton were to be expanded.

The Social Effects on Area Residents

The eastern part of the Toronto-Centred Region, in which the new Toronto airport has been located, is no longer truly part of rural Ontario. Under the pressure of increasing land values which relate to development potential rather than market value for farming purposes, many farms have changed hands so that less than 50% of the area to be acquired is owned by those who farm it. Farming communities are rapidly becoming dormitory communities, and recreation farms are becoming more and more significant.

The new Toronto airport is thus located in an area which had already begun to attract the attention of developers. Indeed, the Municipality of Metropolitan Toronto had gone so far as to prepare a fairly detailed outline of the manner in which Pickering might be developed to provide additional building land beyond the present Metro boundary. To the farmers of the area the new airport has done little more than accelerate a change which has been underway for a number of years. The majority of farmers have recognized this by giving their support to the airport proposals.

Some businessmen who live outside the area to be acquired, but who serve its inhabitants, have expressed fears that their livelihood may be affected as people move out of the land required for the airport. It must be emphasized that only a comparatively small number directly affected by

construction will have to move in the early years. The Federal and Provincial Governments have both indicated their intent to seek to minimize any negative effects in such unique circumstances. Overall, the influx of spending power resulting from airport construction and operation will more than offset any possible losses, and the general expansion of economic activity will result in an increase rather than a decline in opportunity.

Fair Treatment

The new Toronto airport will undoubtedly bring significant social benefits to the majority. The Federal Government will ensure that in so doing it will treat fairly those who will directly be affected in an adverse way. The provisions of the federal Expropriation Act are designed to achieve this, and the administrative procedures adopted by the Ministry of Transport are designed to give effect to this policy of fair treatment for all.

The Expropriation Act of 1969 contains a number of provisions which specifically protect the property owner. Compensation is given for adverse effects caused by government expropriation and there are ample appeal procedures should he be dissatisfied with the initial compensation offered. If the property owner decides that he is not satisfied with the Government's offer of compensation he may, as stated above, accept payment of the amount offered without

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influencing further negotiations. In this event, at the request of either the owner or the Minister, an independent negotiator will be appointed to try to arrange a settlement. Should this fail, the owner may file suit in the Federal Court of Canada.

Once the expropriation of a property is confirmed, the owner is entitled to a minimum of ninety days' notice before the Federal Government may take possession. He must also have received an offer of compensation from the Minister of Public Works before the government can take possession, although it is not necessary for all claims to have been settled in court prior to this.

Continuing Occupation

Compensation will be paid forthwith to those who wish it up to the amount of the offer made by the Federal Government. In addition, the great majority of residents will have the opportunity of continuing to occupy their homes or farms for some time under reasonable rent-back arrangements. This means that most residents can remain on their former property for a modest rental charge until they find a suitable alternative location.

Detailed design work, tendering and awarding of contracts will take many months before construction can commence.

This means that even those property owners in the immediate construction area (a comparatively small part of the total expropriated land) may expect to be able to remain for several months, and would only have to move immediately under exceptional circumstances.

Flight operations will not commence until the late seventies. Therefore, many of the residents located on expropriated property but not in the immediate construction area will not have to move for several years. For this reason it may be that 90% of farming activity can continue within the expropriated area until the airport is commissioned, and a large part of this indefinitely thereafter.

The Social Effects of Airport Construction

Many new jobs will result from the development. The airport construction itself will create several thousand temporary and permanent jobs, and it is possible that some area residents will be able to work on the project in the earlier ground clearing and construction stages. The development will necessitate some relocation of employment for a limited number of existing operations. Every measure of assistance will be provided by the Federal Government officials in finding suitable alternative locations for such operations and for finding alternative employment for those whose jobs are affected.

By bringing increased employment into the eastern part of the Toronto-Centred Region, the new airport will considerably broaden the range of employment opportunities open to those who live there. The increased population, stimulated by the economic leverage of airport construction and population, will support a higher level of services to both existing communities and planned new communities. The planned development of these communities will offer opportunities for social advancement as well as economic prosperity.

Conclusion

The decision to construct a new airport was taken to provide convenient service to the ever increasing number of people in the Toronto region who make use of air travel, while minimizing the number of those who will be affected by flight operations. The new Toronto airport is conveniently located, and will meet the traffic needs of the Toronto area with only a fraction of the disruption that would be occasioned were all the traffic to be accommodated at Malton. The Government of Canada, by its policy of fair treatment for all, will ensure the well-being of those directly affected by the development of the airport. In addition, the joint planning undertaken by the federal and provincial governments will ensure that the airport will contribute to the social and economic goals of the Toronto-Centred Region Plan.

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Government
Publications

Toronto Area Airports System

July 11, 1972

ADVANCED GROUND TRANSPORTATION TECHNOLOGY AND THE NEW TORONTO AIRPORT

Transport Canada
Air

Transports Canada
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ENQUIRIES

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THE IMPACT OF NEW GROUND TRANSPORTATION TECHNOLOGY IN PLANNING FOR THE NEW TORONTO AIRPORT

Introduction

One of the major areas of development in ground transportation technology has been in the field of high speed ground transportation equipment. The use of this equipment in the form of new high speed ground facilities will undoubtedly have in the long term considerable impact on the inter-city travel between Toronto and major urban areas in the 300 to 400 mile range.

An in-depth evaluation was made of the impact of several forms of new high speed ground transportation facilities on domestic inter-city air travel originating in Toronto. Evaluation of this impact was then compared to the total demand for future air services in the Toronto area. It was concluded that the new Toronto airport would be required to handle the long haul passenger traffic for which ground transportation is not an alternative.

Present and Future Technologies

Canadians today favour the use of the automobile. There are, however, many inter-city travellers who choose to travel by "common carriers" (bus, railway train and aircraft) for reasons of speed, convenience, cost, etc.

In the last few years, the Government of Canada has carried out a considerable amount of research into the common carrier market to determine its present status and future potential. One of the prime areas of interest is the potential impact of high speed ground transportation on Canadian inter-city travel.

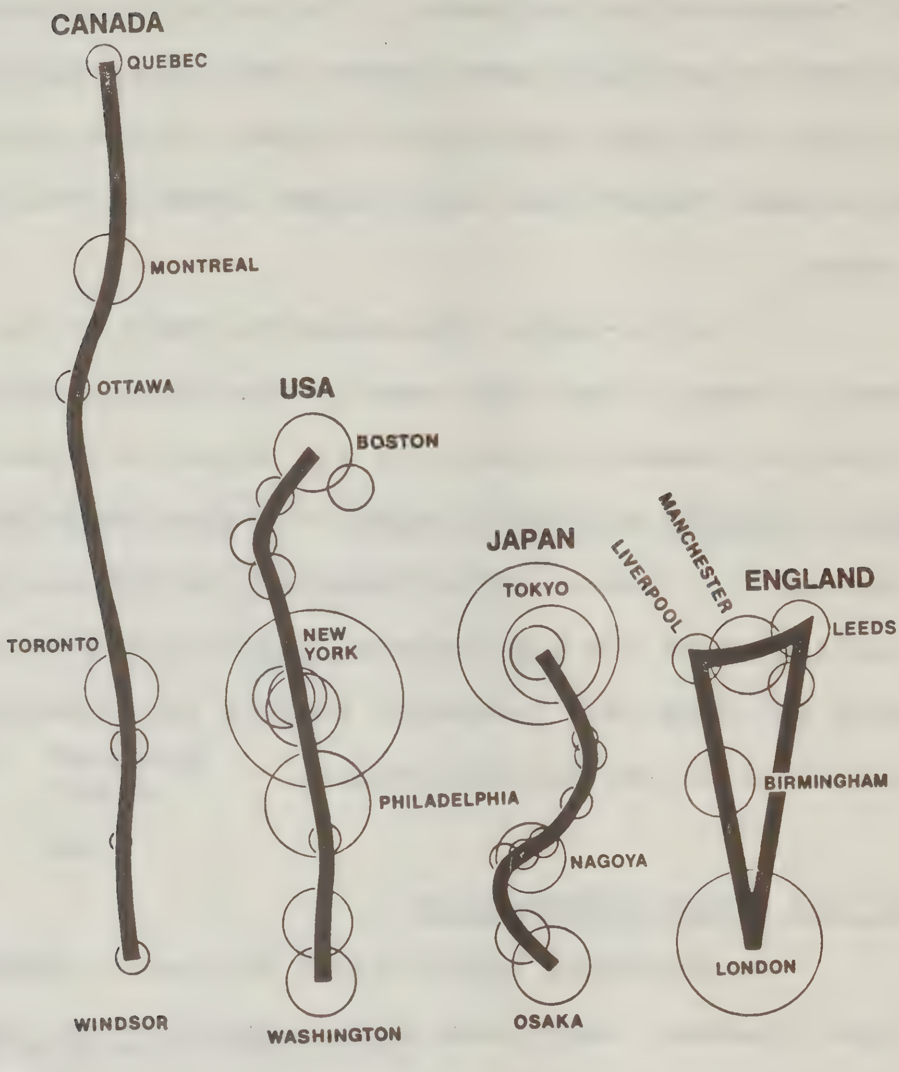

Exhibit 1: A comparison of intercity corridors (length and population are to scale).

In 1970 the Research Branch of the Canadian Transport Commission (C.T.C.) completed a comprehensive study of the forms of transportation technology which might most realistically be considered for possible application in Canada. The study, utilizing much of the research material developed from studies elsewhere examined in detail inter-city travel between Montreal and Toronto with extensions to Quebec and Windsor. Since this corridor is the most densely populated portion of Canada, it will be the most promising area for the introduction of new forms of inter-city ground transportation services. In Exhibit I and Table I the Canadian corridor is compared to other densely populated urban corridors.

It is interesting to note that in the Northeast corridor of the United States, with a linear population density over five times that presently existing in the Toronto-Montreal corridor, authorities are now actively trying to implement such services to alleviate severe congestion of existing systems. Canada is planning for such systems today before congestion develops just as Canada is now planning for adequate airport facilities before deterioration of air service.

TABLE I

Size Comparison of Urbanized Corridors

Corridor	Length (Miles)	Approximate Populations (Millions)	Population Linear Mile
Canada (Windsor-Quebec)	715	10	14,000
Canada (Montreal-Toronto)	325	6	18,000
U.S.A. (Northeast)	450	45	100,000
Japan (Tokyo-Osaka)	370	35	95,000
U.K. (London-Northwest)	200	20	100,000

*From: Intercity Passenger Transport Study, Canadian Transport Commission, September, 1970.

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The research program carried out by the C.T.C. examined in detail the impact of alternative forms of high speed inter-city passenger transportation within the "Canadian Corridor" for the period 1970-1990. These strategies vary from incremental improvements that can be expected to present technology, through different forms of high speed rail systems (HSR) and completely new technologies such as short take-off and landing (STOL) aircraft to tracked air cushion vehicles (TACV). This information has been published by the C.T.C. in the form of an official report that is available to the public from Information Canada (Catalogue number TT 22-1-1970). The results of the C.T.C. study have provided much of the basic information for the analysis that has been carried out by the Toronto Area Airports Project Team.

The summary includes a description of new ground transportation technologies together with time, cost and choice of mode characteristics of the strategies as well as the general conclusions of the study.

Present Travel

The total market for common carrier travel between Toronto and Montreal in 1969 was about 1.2 million trips. The passenger market between these cities was split among the three modes in 1969 as shown in the first columns of Table 2 and is compared to the split for cities in the Northeast Corridor of the United States as shown in columns two and three.

TABLE 2

Comparison of Modal Choice in 1969 Trips by Common Carrier

(by per cent)

Present Mode	Toronto-Montreal Corridor	Boston-New York Corridor	New York-Washington Corridor
Bus	5%	12%	18%
Train	36%	8%	16%
Aircraft	59%	80%	66%
	100%	100%	100%

It is interesting to note that rail in Canada is carrying anywhere between two and four times as much relative to the total amount as is the case in the more densely populated Northeast Corridor.

As can be seen from the information in Table I and Table 2, the United States, particularly in the Northeast Corridor, is now faced with the problem of implementing high speed surface transportation. The United States Government through its Department of Transportation has set up the Office of High Speed Ground Transportation. Through this group studies have been carried out on possible types of equipment and the attractiveness to passengers. Many of these U.S. research reports are listed in the bibliography of the C.T.C. report.

The information in Table 2 is augmented by the information given in Table 3 with respect to its travel time and cost.

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TABLE 3

Average Trip Time and Cost
Montreal - Toronto

	Average Trip Time (Hours)				Average Trip Cost (1969 dollars)		
MODE	ACCESS TIME	TERMINAL TIME	ENROUTE TIME	TOTAL TIME	ACCESS COST	FARE	TOTAL COST
Air	1.0	1.6	1.1	3.7	5.16	25.00	30.16
Rail	.7	1.3	5.0	7.0	1.91	12.40	14.31
Bus	.8	1.0	6.2	8.0	1.64	12.15	13.79

This table indicates that, in terms of door-to-door travel time, the air mode is much faster than either bus or rail (as it presently exists), but that it is correspondingly more expensive. It is clear that travellers are assigning a high value to their time as demonstrated by their choice in greater numbers of the faster but more expensive air mode.

Future Travel

Several types of new ground transportation technologies were investigated in the C.T.C. study for their relative effects on the travel market and the attendant costs. These included high speed rail (HSR) and tracked air cushion vehicles (TACV).

1. High Speed Rail

One of the underlying objectives in the high speed rail strategies is to make better use of existing track facilities through improved vehicles capable of overcoming existing speed restrictions. For example, with new power and

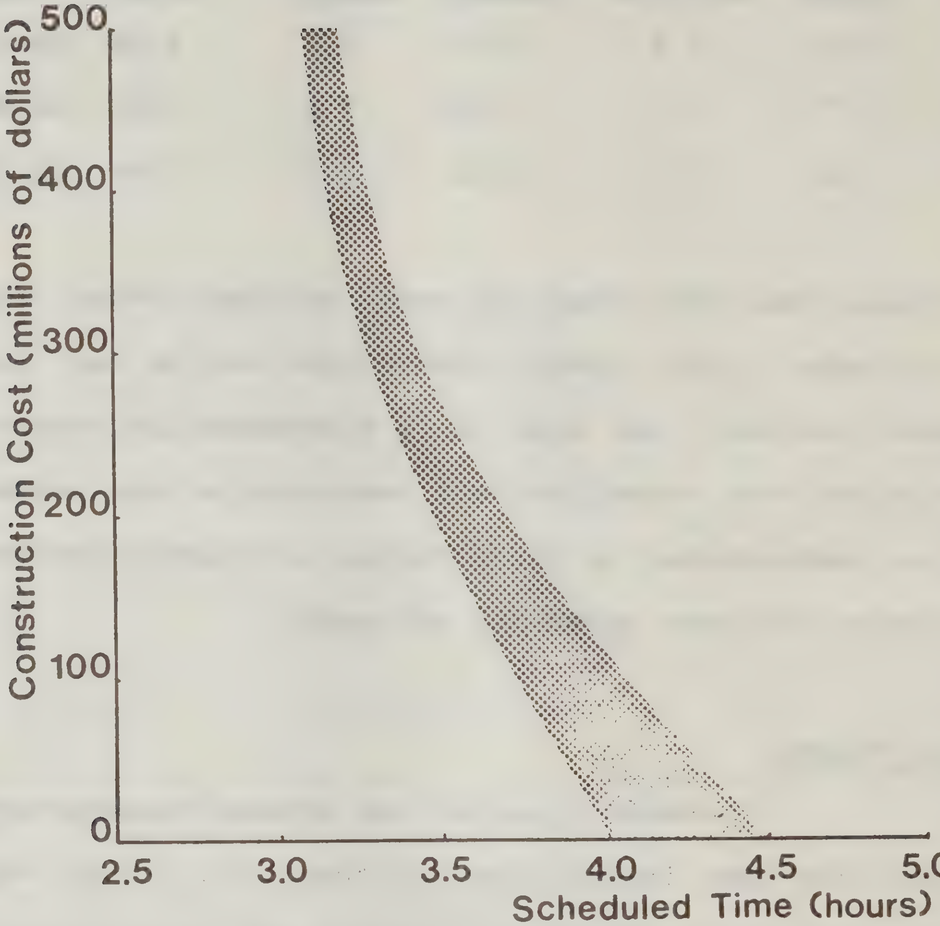


Exhibit 2: Cost of railroad track improvements for higher speed operation between Montreal and Toronto

suspension systems, the Turbotrain which was introduced by CN between Montreal and Toronto in 1968, can operate at higher speeds than conventional equipment. These trains, which derive power from gasoline turbine engines instead of the conventional diesel, were designed to cover the 335 mile trip Toronto-Montreal in less than four hours. Although the trains have experienced some mechanical difficulties and have been temporarily removed from service CN now plans to have the Turbotrains back in service early in 1973.

Units similar to the Turbotrain are being developed. These include the Advance Passenger Train in the United Kingdom and the LRC (light, rapid, comfortable) Train currently being developed by a Canadian consortium.

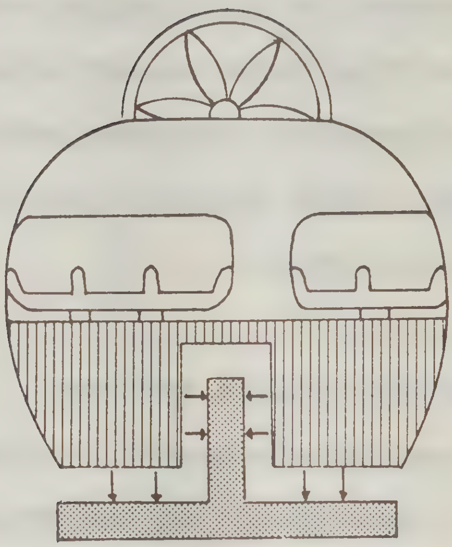
However, there is a limit to the speeds that can be achieved through improvements in vehicle technology alone. To exceed these limits, improvements must be made in the track structure and alignment. Exhibit 2 shows the estimated cost of track improvements required to decrease schedule times between Montreal and Toronto. The width of the band represents performance differences between various types of equipment. With no investment in trackage, conventional equipment with a high power-to-weight ratio (such as an improved Rapido) can maintain a 4½ hour schedule while Turbotrains can operate on a 4 hour schedule. In order to reduce this running time, capital investment will be required to reduce curvature, eliminate grade crossings, improve signal systems and strengthen track structures. It is for this reason that the strategy of improving the vehicle rather than investing money in the track has been actively pursued to date.

The 500 million dollar maximum shown on Exhibit 2 involves reconstruction of the entire 335 miles from Montreal to Toronto to a 135 m.p.h. standard. It should be noted that this curve cannot be extrapolated upwards because the speed then becomes such that it requires an entirely different track structure and therefore a different magnitude of cost would apply.

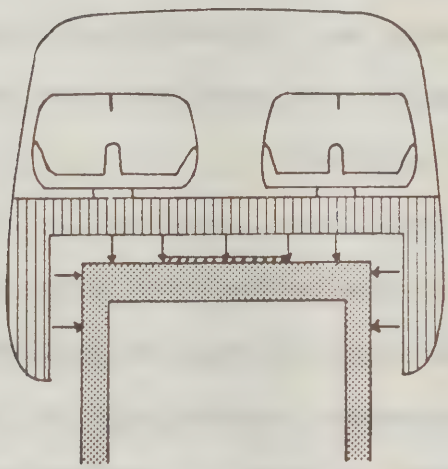
2. Tracked Air Cushion Vehicle Systems

Railway speeds cannot be increased beyond a maximum limit which corresponds to the maximum force that can be transferred between steel wheels and steel rails. Japanese experience suggests that 200 m.p.h. is the practical upper limit while European railroad experts indicate that slightly higher speeds may be possible. However, to attain speeds of this order in the corridor, an entirely new alignment would be required.

The high cost involved in a new alignment suggests the feasibility of a new technology which is free from the technological limitations of current railroad operation. A promising ground transport technology is the Tracked Air Cushion Vehicle (TACV) concept, a system of high speed vehicles supported and guided by cushions of air and operating on a fixed guideway. Other technologies are being developed but, for the purpose of this study TACV was considered to be representative of the performance characteristics.



Bertin I-80 Aerotrain
(First Generation TACV)



Tracked Hovercraft Limited
(Second Generation TACV)

Exhibit 3: Cross-section of Tracked Air Cushion Vehicles

Development work on TACV's is underway in four countries: France, Britain, the U.S.A. and Japan. Bertin et Cie, a French company, has pioneered the development of the TACV and has built and operated the "Aerotrain" utilizing a propeller-driven vehicle operating on an inverted "T" shaped guideway. Maximum speed of the prototype approaches 190 m.p.h. with cruising at 155 m.p.h. It was this first generation system that was used in the CTC study for order of magnitude construction and operational costs. An estimate of 550 million dollars is given in the study for capital costs of a 350 mile double track TACV system between Montreal, Ottawa and Toronto.

The British Company, Tracked Hovercraft Limited, has operated scale models with linear motor propulsion and has completed a full scale test track. This system represents a second generation TACV and uses vehicles which straddle a box-beam. Exhibit 3 shows the cross section of the two generations of tracked air cushion vehicles. The development of the second generation TACV's has not reached a position where reliable estimates of construction and operating costs could be made but the costs are expected to be greater than the costs for the first generation.

For the analysis purposes of the C.T.C. study it was assumed that a TACV system could be operational between Montreal, Ottawa and Toronto by 1980. This projected date could prove to be optimistic because development and testing of the vehicles has not been done under conditions similar to Canadian winters and this could necessitate many design changes similar to those required with respect to the Turbotrain.

3. Time, Cost, and Modal Split Characteristics

Table 4 summarizes the average travel time and cost for the various modes studied for a Montreal-Toronto trip.

TABLE 4

Average Trip Time and Cost, Montreal-Toronto with Alternative New Technologies

	Average Trip Time (Hours)				Average Trip Cost (1969 dollars)		
MODE	ACCESS TIME	TERMINAL TIME	ENROUTE TIME	TOTAL TIME	ACCESS COST	FARE	TOTAL COST
HSR 1	.7	1.3	4.0	6.0	1.91	13.90	15.81
HSR 2	.7	1.3	3.5	5.5	1.91	13.90	15.81
HSR 3	.7	1.3	3.0	5.0	1.91	13.90	15.81
TACV	.7	0.7	2.5	3.9	1.91	20.00	21.91

The time and cost involved in reaching terminals are based on averages derived from the origin-destination survey. These survey values have been applied to new systems on consideration of the type of traveller likely to be attracted to the mode, and the probable general location and design of terminals. Access time and cost, as perceived by surveyed rail passengers, are used for both the TACV and high speed rail options.

For the improved rail system, terminal times (passenger processing and waiting times) are assumed to be unchanged from current values for rail travellers. The high service frequency of the TACV system, together with no-reservation operation and a minimum of passenger processing, suggest that terminal times for TACV users would be relatively low. The variation of processing times (as perceived by the

traveller) is another factor influencing terminal times and in the TACV system this "risk" time is expected to be lower than for the other modes. On this basis, TACV terminal time is set at 40 minutes, or about 20 minutes less than reported terminal times for bus travellers.

In the first rail strategy, train equipment capable of higher speeds on existing track is introduced and retained through the remainder of the study period. Costing is based on seven-car integral units (as adopted for the CNR Turbotrain) coupled to give 7, 14 and 21 car trains as required by passenger volumes. Scheduled trip time between Montreal and Toronto is four hours.

In the other two rail strategies, 3½ and 3 hour rail service is initiated between Montreal and Toronto in 1976. These service improvements involve investment in track improvements estimated at 200 and 500 million dollars respectively. Improvements for the 3½ hour service are assumed to be completed over the two years prior to operation while construction costs for 3 hour service are distributed over three years.

For each of the three rail strategies, an "optimum" fare was estimated for the Montreal-Toronto service by performing the analysis for three rail fares while holding bus and air fares unchanged. This "best" fare was taken as the rail fare which would result in the greatest excess of revenues over operating costs for the total common carrier system.

The tracked-air-cushion vehicle concept is tested in a strategy which would bring a TACV system into operation on a Montreal-Ottawa-Toronto alignment in 1980. It is assumed that with the introduction of TACV service, rail would no longer serve intercity traffic between these centres. TACV operating costs are based on the first generation Aerotrain I-80 system assuming an average load factor of 75%. Montreal-Toronto block time is taken as 2½ hours. A fare of approximately six cents per passenger mile was found to produce the most profitable system. The TACV strategy involves an estimated 520 million dollar investment in fixed facilities such as track structure, terminals and utility relocation. For costing purposes this construction is assumed to be carried out over a three year period peaking in 1978 with completion for operation in 1980.

This study is concerned with the contribution which new technology could make to the overall transportation system, a "maximum-system-profit" criterion is used. The resulting fare levels may not be "best" fares from the point of view of individual carriers although it can be shown that the total system is insensitive to fare change.

The three rail strategies involve reduction of the present travel time between Montreal and Toronto through a combination of improved vehicle technology and capital investment in existing railway facilities. HSR 1 (High Speed Rail-Alternative 1) relies entirely on new vehicle technology of the Turbotrain variety to achieve higher speeds on existing facilities. This would involve schedule times of approximately four hours. HSR 2 and HSR 3 involve successive reductions in

this schedule time to 3½ and 3 hours respectively, through investment in curve reductions, grade crossing protection and improved vehicle technology.

The estimated per cent of the total common carrier traffic carried by each mode that was derived in the study is shown in Table 5. For example, if the strategy HSR 1 were chosen, 55% of the common carrier traffic would use air services, 6% would use bus services and 39% would use rail services. For the TACV strategy, it is estimated that the air market would be 18% and the TACV market 77%.

TABLE 5

Modal Split, Monteal - Toronto
with Alternative New Technologies

	Percent by each Mode		
Technology	Air	Rail or TACV	Bus
Present Technology	59%	36%	5%
New Technology			
HSR 1 (1971-1990) *	55%	39%	6%
HSR 2 (1976-1990)	49%	46%	5%
HSR 3 (1976-1990)	42%	53%	5%
TACV (1980-1990)	18%	77%	5%

* Possible date for full scale operation in 1970-1990 study period.

The study also investigated the impact of the introduction of short-take-off-and-landing (STOL) aircraft in the corridor. It was found that a second generation STOL aircraft would have superior performance characteristics in terms of door-to-door time by comparison with the high speed

ground modes, would require significantly smaller capital investments in fixed facilities, was much more adaptable to a staged program of implementation, but would have operating costs significantly higher than ground transportation modes. It was estimated that if this type of STOL service was implemented in competition with the existing railroad system the proportion of the market taken by air services would be 69% while rail would by 26%. Clearly STOL and advanced ground transportation systems would be competing services and that neither are real alternatives for the medium and long haul travel market.

Summary and Conclusion from Review of the CTC Study

Some of the major points respecting new technologies as applied to the Montreal-Toronto corridor may be summarized as follows:

1. There is no significant inter-city travel congestion in the corridor at the present time, and expected increases in travel demand can be accommodated by incremental changes to existing modes in the 1980's.
2. STOL, TACV, and HSR, if one of these technologies were introduced, represent modes which could be attractive to many travellers, but investment costs for STOL and modifications to existing rail will probably be substantially less than for TACV. In any event, technological advances must be made before either high performance STOL or TACV become viable.

3. Risk is lower with STOL than TACV since less capital is invested and less of the plant will be "fixed". In the case of STOL any disruption to the environment is only related to the landing and take-off areas whereas TACV involves a corridor between the two cities.
4. Both STOL and TACV systems are point-to-point systems as conceived in the CTC study and, therefore, neither will have the capability of affecting urban development to any great extent. If they are not operated point-to-point overall average travel speeds will be reduced substantially, thereby limiting their effectiveness. In addition the flexibility of a STOL service must be considered. STOL can be routed to meet travel demands. Trial routes can be operated to test market demand. This sort of service can never be offered with TACV, since it requires a very heavy capital expenditure for trackage and right-of-way that are permanently committed to a particular route.

The Impact of High Speed Ground Transportation on Airport Planning

Based on the previous information as documented in this paper the impact on the air mode was assessed.

The existing modal split for the common carrier market between Toronto and Montreal presently stands at 59% air, 36% rail and 5% bus. Based on the research and analysis

carried out by the C.T.C., the maximum impact of HSGT in the form of yet undeveloped second generation TACV would be to reduce the air component of the common carrier market from 59% to 18%. This change in modal split accounts for not only the attraction to TACV from the potential air market, but people who would now choose TACV over the automobile and people who would be travelling because of improved services that TACV could offer. However in planning airport facilities the significant factor that must be considered is the potential number of air passengers that might be attracted to a TACV system through lower cost, equivalent travel time, or a superior level of service, not trips attracted to TACV from other modes.

In addition to considering potential modal split with the introduction of HSGT a review was made of the air market segment that this mode would compete with, namely, short haul domestic flights. If domestic traffic continued to grow at the 1961-1971 rate, in 1990 a volume of 5.7 million annual air passengers would be forecast for the short haul domestic market. This would rise to 12.4 million by the year 2000. However as in the case of the overall passenger forecasts a more conservative estimate was used, so that in 1990 3.5 million annual air passengers are forecast with the number rising to 5.5 million by the year 2000. Modification in the growth rate of this portion of air market is based on assumptions used by the Team that substitute forms of communication will make inroads into the short haul market.

[illegible]

[illegible]

The impact of HSGT service between Toronto and Montreal can now be summarized by comparing the change in modal split caused by TACV in short haul domestic travel to the total Toronto air market for a particular forecast year. If the travel between Toronto and Montreal for the year 1990 is examined in detail, it is forecast that there will be about 2 million annual O-D air passengers between this city-pair, if the present conventional air service is extended to this target year. If quality HSGT service is offered between these cities, a conservative reduction drop in air patronage that could be expected (based on CTC research) would be about 1½ million annual air passengers.

Since the effect of improved services has already been taken into account in developing the forecasts for the short haul market an assumption of further penetration would only reduce the remaining total of some 2 million passengers to about .5 million. This further reduction of 1½ million represents 6 per cent of 25 million annual O-D passengers expected in 1990 which is less than the total increase in air traffic in one year.

The trips between Toronto and Ottawa would be similarly affected by an amount equal to 3 per cent of the total air trips to and from Toronto.

If the year 2000 air market is examined using the same methodologies and assumption as were used in the 1990 analysis, HSGT may be expected to cause just over 6 per cent variation in the total Toronto market as compared to the 7 per cent in 1990. This is due to the fact that the long haul market

is forecast as the primary source of growth in air travel and that it has already been assumed that domestic air travel will be proportionately reduced by the availability of other forms of short haul transportation.

From this review of the C.T.C. Inter-City Passenger Transport Study, and the forecast Toronto air market it is obvious that even if the most sophisticated TACV system were introduced in the Toronto-Ottawa-Montreal Corridor it would, in future years, have a minor effect on total air travel demand and therefore not alter the basic requirement for increasing air service facilities in the Toronto region.

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THE IMPACT OF STOL ON THE TORONTO AREA AIRPORTS SYSTEM

INTRODUCTION

For several years, aircraft capable of short take-off and landing (STOL) operations have been used throughout the world. This use has centred primarily around small aircraft (up to about 20 seats) directed toward military short-haul, low density commuter and air taxi uses, and operations to outlying areas. More recently, the development of these specialized aircraft has received strong impetus as it has been recognized that larger "second and later generation" aircraft may offer substantial potential for meeting some of the air transportation needs in major urban areas.

Airports built to handle today's conventional aircraft have generally been sited at some distance from the centres of demand for two reasons:

1. The technology available for the conventional air carrier aircraft is such that large runway areas are required (two or more runways of up to 12,000 feet in length) and only shallow climb and descent angles can be used which expose quite large areas on the ground to noise.

2. The airports have the major role of serving the long-haul travel market. In this market there is no effective competition to air travel and the location of the airport at some distance from the centre of demand is not a limiting factor in the decision on whether or not to use air for long distance travel.

Because of the location of such airports so far from the centre of demand, air passengers on short flights find that getting to and from the airport takes a disproportionate amount of the total trip time. For example, an analysis done by the Canadian Transport Commission of the components of total trip time by conventional jet aircraft on the highly travelled Toronto-Montreal corridor showed that on average the ground access portions account for as much of the total door-to-door trip time as does the block-to-block flight portion (start engines to stop engines).

TABLE 1

	TOTAL MONTREAL-TORONTO TRIP TIME - CONVENTIONAL JET AIRCRAFT
Access and Egress	1.02
Terminal Processing	1.40
Flight Block Time	1.08
TOTAL	3.50 hours

The commuting businessman in seeking to spend as much time as possible at his destination and get home the same day, of necessity places very high value on hours saved in transit.

It has been concluded that the operating characteristics of STOL aircraft are such that these aircraft could assist substantially in satisfying the needs of short-haul passengers in major urban areas:

1. The short take-off and landing capability (2000 feet) and substantially reduced noise profile of STOL aircraft may permit the location of STOL airports closer to the centres of demand. Short-haul passenger convenience will be improved as total time between home, office or hotel at each end of the trip is reduced. Another possible advantage is that some portion of short-haul traffic will be off-loaded from the main airport.

2. It may be decided that some or all STOL operations should remain at the main airport because it is conveniently located to serve the short-haul demand.

3. The success of STOL in improving service to the short-haul market depends on its introduction as part of a comprehensive inter-city STOL system with airports, located at the centres of demand in all urban areas served, so that significant savings in total trip time can be achieved over service currently provided by conventional short-haul aircraft. The savings in time will occur primarily in the access/egress portion of the trip, as it is anticipated that later generation STOL aircraft will have the same flight times and only slightly reduced terminal processing times.

Before examining the possible impact of STOL on the Toronto Area Airports System, a few facts should be noted concerning the characteristics of the short-haul air travel market and the types of vehicles that are presently being

explored to serve this market in the future. Short-haul is defined as trip length less than 500 miles. Table 2 following outlines several key statistics on the anticipated growth of the short-haul air travel market in relation to total air traffic activity. As can be seen, short-haul traffic at Toronto, in terms of both passenger and aircraft movements, is forecast to continue to grow over the next thirty years, but at a less rapid rate than the remaining long-haul portion of the air travel market. Thus short-haul will have a gradually declining share of total passengers and aircraft movements.

Aircraft operating on the short-haul segment are less noisy than those serving the remainder of the market. A large proportion of the short-haul aircraft movements is made up of the quieter smaller aircraft. Intensive analysis of noise characteristics by sector distance has shown that when the larger long range aircraft, such as the DC-8, are used on short-haul, their noise impact is reduced considerably. When opera[illegible] on short-haul, take-off weight of the large aircraft is somewhat lower principally because the fuel load is reduced so that shorter take-off runs and steeper departure angles are used. Thus, replacing some of the conventional aircraft now serving the short-haul market with a quieter STOL aircraft would not reduce the noise problem to any great extent at Malton.

TABLE 2

AIR PASSENGER AND AIRCRAFT MOVEMENT FORECASTS FOR TORONTO

	AIR PASSENGERS				AIR CARRIER PASSENGER AIRCRAFT MOVEMENTS (SCHEDULED AND CHARTER)			
	1970 (ACTUAL)		2000		1970 (ACTUAL)		2000	
	Number (Millions) (Enplaned x 2)	Percent of Total	Number (millions) (Enplaned x 2)	Percent of total	Number (Thousands)	Percent of Total	Number (Thousands)	Percent of Total
Short-haul (less than 500 miles)	3.2	50.8%	18	28%	82.9	70%	172	59%
Long-haul (over 500 miles)	3.1	49.2	44	72%	35.0	30%	121	41%
TOTAL	6.3	100%	62	100%	117.9	100%	293	100%

For so long as that airport is used to accommodate long-haul flights, the large aircraft employed will make a significant impact in terms of noise experienced. This impact is greatest in summer when people are enjoying their gardens and long-haul recreation traffic is at its peak.

In any analysis of the short-haul market, alternative transportation modes must be considered. In 1970, the Canadian Transport Commission completed a comprehensive analysis of new forms of transport technology for possible application in Canada. The study was concerned with alternative strategies for developing inter-city passenger transportation within the "Canadian Corridor" from Windsor to Quebec City for the period 1970 to 1990. The strategies analyzed varied from minor improvements to present technology, through high speed rail systems (HSR) and completely new technologies such as STOL aircraft and tracked air cushion vehicles (TACV). With regard to the possible application of STOL to serve this short-haul market out of Toronto, several key points were brought out in the study:

1. STOL, TACV and HSR, if one of these technologies were introduced, represent modes which could be attractive to many travellers, but investment costs for STOL and modifications to existing rail will probably be substantially less than for TACV.

2. Risk is lower with STOL than TACV since less capital is invested and less of the plant will be "fixed". It should be noted that the Montreal-Toronto segment is the only corridor in Canada which could economically support service by

advanced high speed ground transport in the near future, whereas STOL would have the flexibility of providing service between Toronto and other high density short-haul centres in Ontario and the Nortneastern United States with minimum additional investment.

3. With STOL, any disruption to the environment is only related to the landing and take-off areas whereas TACV involves a fixed right-of-way between city pairs.

The aviation industry has developed design concepts for second and later generation STOL aircraft which are specifically designed to serve the short-haul market. Two types are generally recognized:

1. The second generation will be turbo-prop powered and is proposed to carry about fifty passengers at about 300 miles per hour. A STOL operation using these aircraft would probably be commercially viable by the late 1970's.

2. Later generation will be powered by high bypass ratio turbofans and is proposed to carry between 100 and 200 passengers at about 500 miles per hour. A STOL operation using these aircraft would probably be commercially viable by the early 1980's.

A wide varietv of possible aircraft designs is being examined by the aviation industry. These designs vary in such details as number of engines, range, body diameter, engine thrust and the type of high-lift system used to achieve the short runway capability (2000 feet) and steeper climb and descent angles. Most concepts suggest the use of yet-to-be-developed advanced technology lift assist systems such as

internally blown flaps or augmentor wing which use ducted high velocity air flow taken off some compression stage in the engine. Because of the complexity of these advanced high lift systems, it is estimated that earliest commercial use will not be until at least the early 1980's.

As a variation, the Boeing Company has recently developed a preliminary new aircraft design based on intermediate take-off and landing distances using an application of current aircraft high lift technology. This new concept will achieve the desired low noise characteristics of proposed pure STOL aircraft, but would be designed to operate out of 3,000 to 4,000 foot runways. The aircraft, designated Quiet Short-Haul or Q.S.H. by Boeing, would utilize advanced mechanical high lift systems which can be developed from current technology. This adaptation of existing technology offers advantage over the pure STOL concept using jet powered lift assist: aircraft deliveries could possibly be made some three years earlier.

The Ministry of Transport recognizes that the introduction of STOL aircraft into the Toronto area could play an important role in the development of the aviation system.

Various analyses have been carried out therefore to examine the possible impacts of these new aircraft on future operations. The purpose of this discussion paper is to examine the possible effects of this new form of air transport on the Toronto Airports System.

THE IMPACT OF STOL ON THE TORONTO AREA AIRPORTS SYSTEM

Because of the possible impacts of STOL on short-haul passengers in the Toronto system, two major issues were explored:

(i) Could STOL systems eliminate the requirement for a second major airport?

(ii) Would the introduction of STOL aircraft postpone the opening of the second major airport?

The Requirement for a Second Airport

As discussed previously, short-haul air traffic at Toronto is the least rapidly growing segment of the market, although it must be remembered that it will continue to grow. Thus, it is forecast that short-haul will have a declining share of the overall Toronto market, in terms of both passengers and aircraft movements. It was also indicated that aircraft serving the short-haul market contribute to a much lesser extent to the noise annoyance around an airport than do their long-haul counterparts. As well, new

forms of transport technology, including both air and ground vehicles, are being actively investigated specifically for the short-haul travel market. For these reasons it was decided to evaluate possible airport sites in the Toronto area which would be specifically located to best serve the short-haul market. This analysis was conducted by the Project Team as part of a major study on the forecast distribution of air passengers in the Toronto-Centred Region. Eleven possible sites, including Malton, were evaluated in relation to the forecast short-haul passenger demand by zone within the region. The sites were combined into systems of two to six airports, with Malton in each combination. Passengers were assigned to the airports from each zone on a minimum highway travel time criterion (maximum convenience).

The locations examined were:

Malton
Toronto Island
Vicinity of Pickering
Hamilton/Mount Hope
Kitchener-Waterloo
Oshawa
Aurora
Guelph (West Site)
Barrie
Lake Scugog (East Site)
Hamilton Waterfront
Peter's Corners

The results of this study indicated that:

1. Air travel demandin Southern Ontario is widely distributed;
2. A number of the locations examined operated together as a system would provide convenient service for short-haul travel throughout the Region;
3. Malton, close to Metropolitan Toronto, is very well located to continue as an airport in this new system.

By both 1990 and 2000, Malton would attract well over half of the short-haul passengers in all of the potentially viable airport combinations examined. Analysis of the forecast short-haul passenger distribution shows that over two-thirds of these passengers are within Metropolitan Toronto or its immediate environs and that Malton is most conveniently located to serve this demand. For example, one of the airport combinations studied was Toronto Island plus Malton. The results indicated that the Island Airport could attract up to a maximum of about 20% of the short-haul passengers or about 3 million by 2000. (This represents about 5 per cent of total forecast passengers in the Toronto System in 2000). The remaining short-haul passengers would be most conveniently served out of Malton. Similar analyses were carried out on other airports combinations with essentially the same results.

Additional analysis showed that a waterfront airport in Toronto with ideal STOL service (later generation aircraft with downtown airports in other centres served) might attract even more business short-haul traffic. However, this increase would come as a result of new passengers generated in the system rather than the capturing of existing short-haul passengers using Malton; that is, an overall expansion of short-haul demand by about 2.5 million passengers in the year 2000. This effect is also recognized

in the Canadian Transport Commission Study. With the introduction of either second generation STOL or TACV, there would be an overall increase in common carrier passenger volume above "present technology" volumes which would be made up of two components:

1. New passengers generated by the reduced travel time.
2. Diversion of trips from automobile to the other carriers from the improvements in the common carrier mode.

The conclusions of this study have a significant impact on the nature of the Toronto Area Airports System. It is obvious from the analysis that the possible introduction of STOL to serve the short-haul market does not preclude the need for a new airport. Short-haul traffic, regardless of the type of vehicle used (conventional or STOL) should continue to be served out of Malton and at least some portion of long-haul traffic should be relocated to another major airport in the region to ensure that Malton will be operated within the environmental and sociological constraints placed on it.

The new STOL aircraft would only replace some portion of the conventional aircraft serving the short-haul market. This group of conventional aircraft are already at the quieter end of the conventional aircraft noise spectrum. It

is the long-haul aircraft which service the fastest growing market segment, which is making the major contribution to noise annoyance.

Effects on the Timing of the Opening of the Second Airport

The possible effect of the introduction of STOL on the opening date of the new airport was evaluated by the Toronto Area Airports Project Team. The overall effect of introducing these new aircraft is to offer better service to the short-haul passenger in the Toronto area, provided that it is introduced as part of a complete STOL system. The effect of this on the system is dependent on the generation and timing of the STOL aircraft introduced.

STOL turboprop aircraft, because of their relatively slow speed, could only expect to attract a small proportion of the short-haul market. To be at all competitive the destinations served would have to be quite near and airports would need to be located in close proximity to the centres of demand. It is estimated that the number of passengers that this first generation might attract would be substantially less than the total annual increment in passengers in the Toronto area so that the effect of this vehicle on noisier conventional aircraft movements would be insignificant. In addition, because of the smaller size of these first and second generation aircraft, it

is possible that their use would in fact mean a greater number of movements to serve the forecast demand.

The later generation aircraft, with their substantially higher cruising speed, could be expected to attract a more significant portion of the short-haul market. However, in order to achieve this, these aircraft would have to be introduced as part of a comprehensive inter-city STOL system (Airports located at the centres of demand in all major urban areas in the system) so that they could provide significant savings in total trip time over service by conventional short-haul aircraft.

In considering service by these aircraft in the Toronto area, it must be remembered that analysis has shown Malton to be one of the most convenient locations for their operation. Thus, although some improvement in operations at Malton may be achieved by the replacement of conventional short-haul aircraft by STOL, the advantage will be short-lived if the new airport is not constructed. To achieve long-term improvements at Malton the majority of long-haul traffic must be relocated to the new site.

It is concluded, therefore, that regardless of whether short-haul traffic is removed from Malton to a new short-haul airport, or conventional short-haul aircraft at Malton are replaced by quieter STOL aircraft, the opening of the second airport cannot be delayed.

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CONCLUSIONS

The introduction of a true inter-city STOL service prior to the opening of a new airport is dependent upon the solution of many technical and operational problems. The design and development of the advanced technology engines and high lift systems are in a preliminary state, particularly for the later generation aircraft. As well, the success of such a service is highly dependent upon the establishment of a system of airports located at the centre of demand in each of the urban areas to be served. Nevertheless studies have clearly demonstrated that STOL can make a substantial contribution to inter-city travel.

STOL service, however, would only have a minimal impact on the requirements for the new international airport even if introduced prior to 1980 because:

1. It would not preclude the requirement for the new airport as the more rapidly growing long-haul segment, which has the noisiest aircraft, must be relocated to the new site if Malton is to be operated within the constraints placed on it.

2. Any delay indicated in the proposed opening date of the new airport would only be minimal. Whatever improvement in operations is achieved by the replacement of conventional short-haul aircraft by STOL aircraft at Malton will be short-lived as it will be taken up almost immediately by the more rapidly growing long-haul segment.

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WEATHER AND THE NEW TORONTO AIRPORT

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WEATHER

How Does the Weather Affect an Airport?

Operations at an airport are affected to a very great extent by local weather conditions.

The presence of fog, haze and smoke can reduce visibility. During these periods it is often necessary for all aircraft to operate under instrument flight rules. For reasons of safety in such circumstances, a much greater separation between aircraft must be maintained. The result is that the ability of the airport to handle air traffic can be significantly reduced. Fewer aircraft can take off and land in a given time and consequently flight delays and cancellations occur. In many instances aircraft attempting to land must be diverted to other airports. Delays and diversions are both costly and annoying to airlines and passengers alike.

The prevailing wind directions dictate the design and location of the runways. No matter what their size, aircraft must take off and land approximately into the wind. All aircraft can tolerate some measure of crosswind during take-off or landing, but at most airport sites there is sufficient variability in the wind direction and its intensity to necessitate at least two runways. If a properly designed runway is not available, flight delays and diversions may result.

Freezing rain, sleet and heavy snow can slow down air operations or bring them to a halt.

In the meteorological context, these and other considerations must be carefully evaluated in selecting a site for a future airport. The best location, therefore, is one which is least affected by weather conditions.

How Are Local Weather and Wind Conditions Predicted?

Local weather conditions at the sites considered for location of the new Toronto airport were predicted by the Atmospheric Environment Service of the federal Department of the Environment (formerly the Canadian Meteorological Service of the Ministry of Transport). The Atmospheric Environment Service maintains meteorological records dating back many years -- the data in these records having been obtained by actual observations. By combining this historical data with an intimate knowledge of area topography, variations in the weather at the airport sites being considered were estimated.

Variations in airport weather in the Toronto area are mainly the result of regional topography and proximity to Lake Ontario. In the absence of these factors, there would be little difference in climate from one location to another.

One outstanding land feature that influences local weather is the Niagara Escarpment which extends westward from Niagara Falls to Hamilton and then northward to Orangeville and Collingwood. Another important land form is the Oak Ridges Moraine which extends east from Orangeville to the southeast of Peterborough. It differs from the Niagara Escarpment in orientation, in general tending to parallel the prevailing winds. Lake Ontario is an important source of heat and moisture and also influences the wind direction.

Variations in topography such as these cause the major differences in weather conditions from one part of the region to another. By analyzing the behaviour of prevailing winds over these water and land forms, predictions of ceilings and visibilities, wind direction and speed, snowfall and rainfall have been made.

What Weather and Wind Conditions Will Prevail at the New Toronto Airport?

Analysis has shown that weather and wind conditions at the site of the new Toronto airport will be quite favourable. Both the site and Malton are located in a very narrow belt near Lake Ontario where terminal weather is superior to that which exists in other parts of the region. Their location with respect to Lake Ontario and the Oak Ridges Moraine is the reason for these favourable predictions.

Other sites evaluated were located in an area of high storm activity - for example, the Orangeville (NW) site because of its location to the Niagara Escarpment. Estimated annual snowfall at the new Toronto airport is expected to be higher than at the present Toronto International Airport but significantly lower than that experienced at Ottawa and Montreal International Airports.

Within the range of runway orientations possible, and considering predicted surface wind conditions, runway usability will be excellent. Overall usability of the new airport under conditions of low ceiling and visibility is predicted to be approximately equal to that of Malton and as good as, or better than, any other site considered.